Industry Biosecurity Plan for the Nursery Industry

Version 3.0 May 2013

Plant Health AUSTRALIA

Nursery & Garden Industry Australia

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Endorsement

The *Industry Biosecurity Plan for the Nursery Industry* (Version 3.0) was formally endorsed by the nursery and garden industry (through Nursery & Garden Industry Australia) in March 2013, and the Australian Government and all state and territory governments (through the Plant Health Committee) in April 2013.

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List of acronyms

ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ACPPO	Australian Chief Plant Protection Office
AQIS	Australian Quarantine and Inspection Service
AS/NZS	Australian Standard/New Zealand Standard
BOLT	Biosecurity On-Line Training
CCEPP	Consultative Committee on Emergency Plant Pests
CEO	Chief Executive Officer
DAFF	Department of Agriculture, Fisheries and Forestry
DAFF Qld	Department of Agriculture, Fisheries and Forestry, Queensland
DAFWA	Department of Agriculture and Food, Western Australia
DECWA	Department of Environment and Conservation, Western Australia
DPIF NT	Department of Primary Industry and Fisheries, Northern Territory
DPI NSW	Department of Primary Industries, New South Wales
DPI Vic	Department of Primary Industries, Victoria
DPIPWE Tas	Department of Primary Industries, Parks, Water and Environment, Tasmania
DQMAWG	Domestic Quarantine and Market Access Working Group
EPP	Emergency Plant Pest
EPPRD	Emergency Plant Pest Response Deed
FAO	Food and Agriculture Organization of the United Nations
FMS	Farm Management System
HACCP	Hazard Analysis Critical Control Point
HPP	High Priority Pest
IBG	Industry Biosecurity Group
IBP	Industry Biosecurity Plan
ICA	Interstate Certification Assurance
ICON	Import Conditions Database
ILC	Industry Liaison Coordinator
ILO	Industry Liaison Officer
IPM	Integrated Pest Management
IPPC	International Plant Protection Convention
IR	Import Requirement
IRA	Import Risk Analysis
ISPM	International Standards for Phytosanitary Measures
LPCC	Local Pest Control Centre

MICoR	Manual of Importing Country Requirements
NAQS	Northern Australian Quarantine Strategy
NGI	Nursery & Garden Industry
NGIA	Nursery & Garden Industry Australia
NGINA	Nursery & Garden Industry New South Wales and Australian Capital Territory
NGINT	Nursery & Garden Industry Northern Territory
NGIT	Nursery & Garden Industry Tasmania
NGISA	Nursery & Garden Industry South Australia
NGIQ	Nursery & Garden Industry Queensland
NGIV	Nursery & Garden Industry Victoria
NIASA	Nursery Industry Accreditation Scheme, Australia
NGIWA	Nursery & Garden Industry Western Australia
NMG	National Management Group
NPFMS	Nursery Production Farm Management System
NPSRT	National Plant Surveillance Reporting Tool
PaDIL	Pest and Disease Image Library
PCN	Potato Cyst Nematode
PHA	Plant Health Australia
PHAC	Plant Health Assurance Certificate
PHC	Plant Health Certificate
PIRSA	Primary Industries and Regions South Australia
QA	Quality Assurance
RIFA	Red Imported Fire Ant
SARDI	South Australian Research and Development Institute
SPC	Secretariat of the Pacific Community
SPCHQ	State Pest Control Headquarters
SPHDS	Subcommittee on Plant Health Diagnostic Standards
SPS	Sanitary and Phytosanitary
TYLCV	Tomato yellow leaf curl virus
TST	Threat Summary Table
WTO	World Trade Organization

EXECUTIVE SUMMARY

Executive Summary

To ensure its future viability and sustainability, it is vital that the Australian nursery and garden industry minimises the risks posed by exotic pests and responds effectively to plant pest threats. The Industry Biosecurity Plan for the Nursery Industry is a framework to coordinate biosecurity activities and investment for Australia's nursery and garden industry. It provides a mechanism for industry, governments and stakeholders to better prepare for and respond to, incursions of pests that could have significant impacts on the nursery and garden industry. It aims to assist production nursery owners and managers to evaluate the biosecurity risks within their everyday production and business activities, formally identify and prioritise exotic plant pests (not currently present in Australia) and focus on future biosecurity challenges.

The Industry Biosecurity Plan for the Nursery Industry was developed in consultation with the Industry Biosecurity Group (IBG), a select group of plant health and biosecurity experts. The IBG was coordinated by Plant Health Australia (PHA) and included representatives from Nursery & Garden Industry Australia and PHA.

A key role of the industry biosecurity plan was the compilation of the Threat Summary Tables, a list of more than 140 example exotic plant pests and the potential biosecurity threat that they represent. Each pest was given an overall risk rating based on four criteria; entry, establishment, spread potential, and economic impact. Through this process, and further consultation, the highest rated pests were identified and highlighted for future surveillance, on-site biosecurity and awareness activities.

The Industry Biosecurity Plan for the Nursery Industry also details current surveillance activities being undertaken by Australia's states and territories, and identifies pests relevant to the nursery and garden industry, for which contingency plans, fact sheets and diagnostic protocols have been developed. This enables identification of gaps and prioritises actions that need to be taken to increase the industry's biosecurity preparedness.

This plan is principally designed for decision makers. It provides the nursery and garden industry with a mechanism to identify exotic plant pests as well as the strengths and weaknesses in its current biosecurity activities. This document is one in a hierarchy of biosecurity documents that the nursery and garden industry has produced to better prepare itself for pest incursions.

INTRODUCTION

Introduction

Plant Health Australia

Plant Health Australia (PHA) is a public company, with members including the Australian Government, all state and territory governments and a range of plant industry organisations. The company was formed to address high priority plant health issues, and to work with all its members to develop an internationally outstanding plant health management system that enhances Australia's plant health status and the sustainability and profitability of plant industries.

Nursery & Garden Industry Australia

Nursery & Garden Industry Australia (NGIA) is the national peak body representing the Australian nursery and garden industry (NGI), and is responsible for overseeing the national development of this diverse and essential industry. This includes liaising with government departments on industry issues, providing strategic direction and leadership and ensuring communication of relevant information. The industry is far broader than the perceived "ornamental" market, and supplies greenlife to a wide array of end users including the forestry sector, revegetation/landcare sector, landscapers, fruit orchardists, cut flower and vegetable growers. NGIA works in very close association with the state and territory nursery and garden industry bodies providing a nationally united position on issues of commonality and importance. NGIA's vision is to build a unified Australian NGI that is productive, profitable and sustainable.

Need for biosecurity plans

Australia's geographic isolation and lack of shared land borders have, in the past, provided a degree of natural protection from exotic threats. Australia's national quarantine system also helps to prevent the introduction of harmful exotic threats to plant industry. Rapid increases in overseas tourism, imports and exports, mail and changing transport procedures (e.g. refrigeration and containerisation of produce), increasing numbers of trading partners as well as the potential for pests to enter via natural routes, mean that there will always be some risk of an exotic pest entering Australia.

Biosecurity planning provides a mechanism for the NGI, government and other relevant stakeholders to actively determine pests of highest priority, analyse the risks they pose and

put in place practices and procedures that would rapidly detect an incursion, minimise the impact if a pest incursion occurs and reduce the chance of pests becoming established.

Ensuring the NGI has the capacity to minimise the risks posed by pests, and to respond effectively to any pest threats is a vital step for the future sustainability and viability of the industry. Through this pre-emptive planning process, the industry will be better placed to maintain domestic and international trade, and reduce the social and economic costs of pest incursions on both growers and the wider community. The information gathered during these processes provides additional assurance that the Australian NGI is free from specific pests, which assists the negotiation of access to new overseas markets.

The Industry Biosecurity Plan (IBP) for the nursery industry was developed for NGIA, and therefore is focused on production nurseries covered by this association. In the event of an incursion, operations that are not covered by the NGIA or another Emergency Plant Pest Response Deed (EPPRD) signatory (e.g. retail nurseries), will not be represented or have a decision making say in any arrangements for emergency response.

Background on the nursery and garden industry

Australian nursery and garden businesses make up a multi-billion dollar industry that plays a vital part in the human (community and personal), environmental and economic well-being of the wider Australia community. The combined 'supply chain' of the Australian NGI has an annual value exceeding $6 billion. This includes the farm-gate value of propagation and growing of green life for application in forestry, amenity and food horticulture. The NGI employs approximately 45,000 people spread over more than 20,000 small to medium sized businesses including production nurseries and retail outlets. The industry is located predominantly along the Australian coastline and in major inland regions servicing urban and production horticulture.

The production sector is broad based producing in excess of 10 000 plant species with many and varying target markets that have an estimated annual value to the Australian economy exceeding $14 billion (Table 1).

Table 1. *Nursery production supply sectors within Australian horticulture*

Production Nursery	Horticultural markets	Economic value
Container stock[1]	Ornamental/urban horticulture	$2 billion retail value
Foliage plants[1]	Interior-scapes	$87 million industry
Seedling stock[2]	Vegetable growers	$3.3 billion industry
Forestry stock[3]	Plantation timber	$1.7 billion industry
Fruit and nut tree stock[2]	Orchardists (citrus, mango, etc)	$5.2 billion industry
Landscape stock[1]	Domestic & commercial projects	$2 billion industry
Plug and tube stock[4]	Cut flower	$319 million industry
Revegetation stock[1]	Farmers, government, landcare	$109 million industry
Mine revegetation	Mine site rehabilitation	Value unknown
	Total horticultural market value	**$14.5 billion**

The retail distribution channels for green life vary from weekend markets and independent garden centres through to major retail chain and hardware stores. In addition to the retail sector, green life, along with the production of allied gardening products, forms the basis for substantial construction and service sectors of the broader value-added NGI. Such activities include landscaping, revegetation, plant hire, local government public amenities and domestic garden services.

Additionally, parts of the nursery sector service a number of other plant production sectors around Australia. For instance many production nurseries produce seedlings, budwood and small trees for numerous horticultural production industries across Australia, including vegetables, bananas, citrus, pome fruit, strawberries, summerfruit, tropical fruit and viticulture.

These numerous links between the NGI and other sectors highlight the very significant role played by the industry to Australian plant industries and the wider community. These linkages have significant biosecurity implications; of particular note is the fact that many plant pests that affect horticultural crops will also affect the production nurseries that produce seedling or propagating material for that commodity. Similarly, if a horticultural crop pest has a broad host range, it could affect a number of ornamental species, leading to quarantine restrictions on those production nursery products during an incursion. This was seen in the Citrus canker incursion in central Queensland in 2004, when movement of certain ornamental Rutaceae species were temporarily restricted from the affected region.

[1] Data sourced from Market Monitor
[2] Data sourced from Horticultural Handbook 2004
[3] Data sourced from ABARES 2005
[4] Data sourced from industry

The Emergency Plant Pest Response Deed

The EPPRD has been negotiated between the government and industry members of PHA to cover the management and funding arrangements of eradication responses to emergency plant pest (EPP) incidents. The EPPRD came into effect on October 26, 2005 and is a formal legally binding agreement between PHA, the Australian Government, all state and territory governments and 29 plant industry signatories. The EPPRD is based on the following key principles:

- cost minimisation for all Parties
- reimbursement to growers whose crops or property are directly damaged or destroyed as a result of implementing an approved Response Plan
- early detection and response
- rapid responses to exotic pests - excluding weeds in the first instance
- decisions to eradicate are based on appropriate criteria (must be technically feasible and cost beneficial)
- an industry commitment to biosecurity and risk mitigation and a government commitment to best management practice
- cost sharing/payment of eligible costs
- an Agreed Limit for cost sharing (calculated as 2% of local value of production for one year of the Affected Industry Party or as defined in Schedule 14 of the EPPRD). The Agreed Limit can be exceeded with the agreement of Affected Parties.
- an effective industry-government decision making process
- a limit in scope (to only cover exotic pest threats relevant to PHA member industries).

For further information on the EPPRD, including copies of the EPPRD, a fact sheet or frequently asked questions, visit **www.planthealthaustralia.com.au/epprd**.

The definition of a **pest** used in this document covers all insects, mites, snails, nematodes, pathogens and weeds that are injurious to plants, plant products or bees. **Exotic pests** are those not currently present in Australia. **Endemic pests** are those established within Australia.

Pest threats are those that have or are being identified as significant to the industry. The most important threats are defined as **key** or **high priority threats**.

Under arrangements of the EPPRD, EPPs are defined as those that meet one or more of the following criteria:

a) It is a **known exotic plant pest**, the economic consequences of an incident of which would be **economically or otherwise harmful** for Australia, and for which it is considered to be in the regional or national interest to be free of the plant pest
b) It is a **variant form of an established plant pest** which can be distinguished by appropriate investigative and diagnostic methods, and which if established in Australia, would have a regional or national impact
c) It is a **serious plant pest of unknown or uncertain origin** which may, on the evidence available at the time, be an entirely new plant pest, and which if established in Australia would have an adverse economic impact regionally and or nationally
d) It is a **plant pest of potential economic importance** to the area endangered thereby and **not yet present** there or widely distributed and being officially controlled, but is occurring in such a fulminant incursion form, that an emergency response is required to ensure that there is not either a large scale epidemic of regional or national significance or serious loss of market access.

What is industry biosecurity planning?

Industry biosecurity is the protection from risks posed by exotic pests through actions such as exclusion, eradication and control. Effective industry biosecurity relies on all stakeholders, including government agencies, industry and the public (Figure 1).

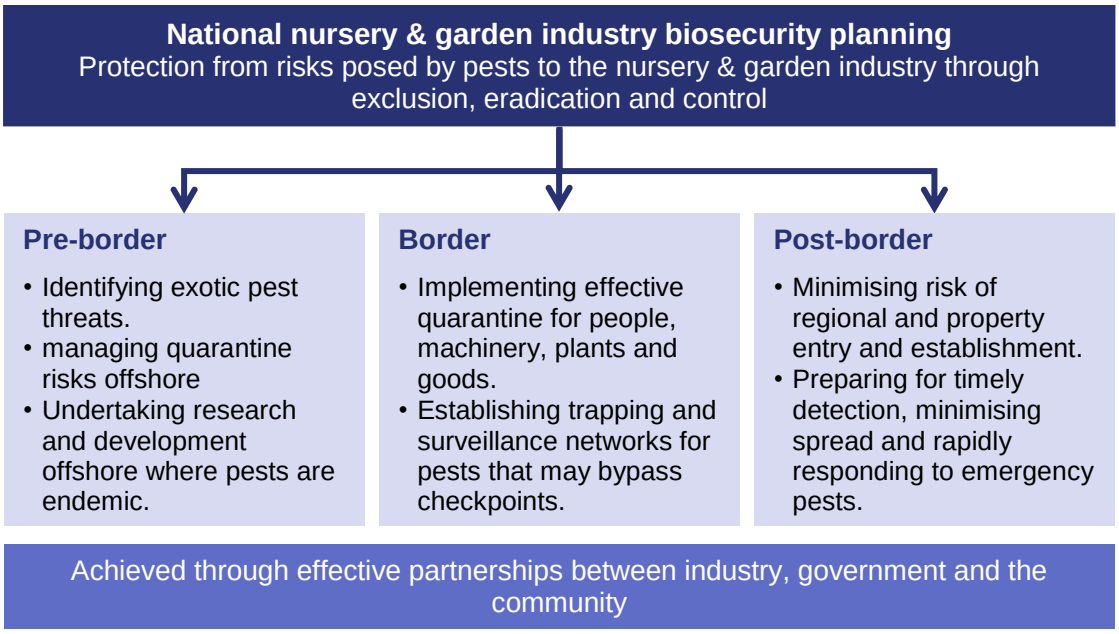

Figure 1. *Industry biosecurity: a shared responsibility*

The components of the plant industry biosecurity continuum have been identified and described in PLANTPLAN, the agreed technical response plan used by jurisdictions and industry in responding to an EPP incident. PLANTPLAN provides nationally consistent guidelines for response procedures under the EPPRD, outlining the phases of an incursion (investigation, alert, operational and stand down), as well as the key roles and responsibilities of industry and government during each of these phases. The incursion management plan from PLANTPLAN (2011) has been summarised in Figure 2.

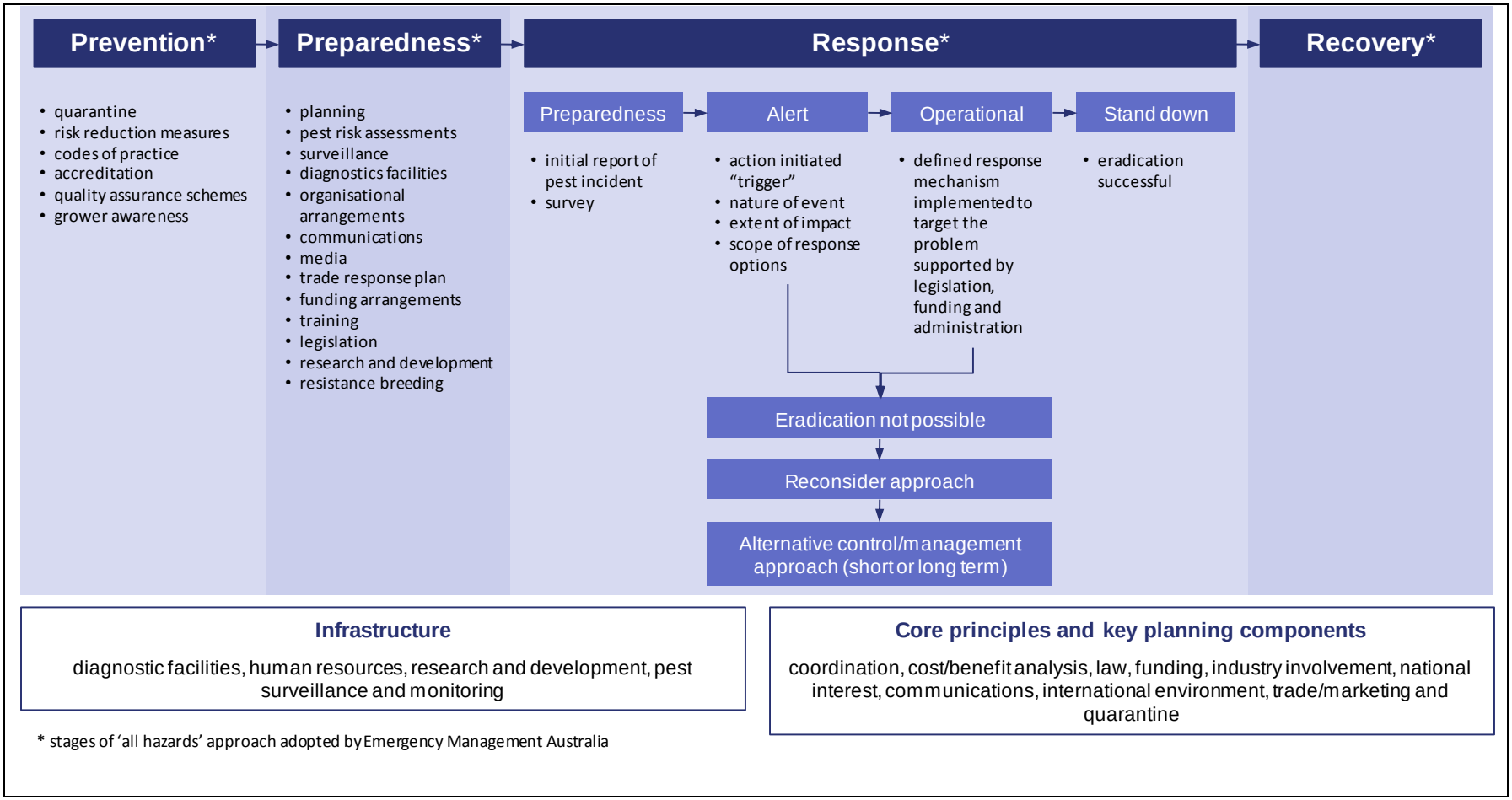

Figure 2. *Summary of incursion management for plant industries according to PLANTPLAN (2011)*

With the assistance of the NGIA, an Industry Biosecurity Group (IBG), coordinated by PHA, was formed to work on the development of a national biosecurity plan for the NGI. The IBG included representatives from NGIA and PHA (Table 2). Other contributors to the IBP included representatives from the Australian Government and relevant state/territory agriculture agencies (Table 3).

Table 2. *Members of the nursery and garden IBG*

Name	Organisation
Anthony Kachenko	Nursery & Garden Industry Australia (NGIA)
Robert Prince	NGIA
John McDonald	Nursery & Garden Industry Queensland (NGIQ)
Grant Dalwood	NGI South Australia (NGISA)
Karen Brock	NGI Tasmania (NGIT)
Matthew Trent	NGI Western Australia (NGIWA)
Megan Connolly	NGI Northern Territory (NGINT)
David Reid	NGI Victoria (NGIV)
Michael Danelon	NGI New South Wales and Australian Capital Territory (NGINA)
Stephen Dibley	Plant Health Australia (PHA)
Felicity Andriunas	PHA

Table 3. *Scientists and others who contributed information for development of the IBP*

Name	Organisation
Andrew Bishop	Department of Primary Industries, Parks, Water and Environment, Tasmania (DPIPWE) Tas
Lionel Hill	(DPIPWE) Tas
Peter Cross	(DPIPWE) Tas
Barbara Hall	South Australian Research and Development Institute (SARDI)
Bill Trend	Department of Agriculture and Food, Western Australia (DAFWA)
Andrew Manners	Department of Agriculture, Fisheries and Forestry, Queensland (DAFF Qld)
Lindy Coates	DAFF Qld
Gordon Berg	Department of Primary Industries, Victoria (DPI Vic)
Stuart Holland	DPI Vic
Kathy Gott	Department of Primary Industries, New South Wales

Key steps in the development of the NGI IBP included:

- identifying and documenting key threats to the NGI
- confirming an agreed high priority pest (HPP) list
- documenting pest-specific contingency plans for HPPs
- documenting the roles and responsibilities of stakeholder groups.

Document overview

The biosecurity package developed for the Australian NGI focuses on a number of key areas.

Threat identification, pest risk assessments and categorisation

Guidelines are provided for the identification and categorisation of biosecurity threats through a process of qualitative risk assessment. The primary goal is to coordinate identification of exotic pest threats that could impact on productivity, sustainability, and marketability and to assess their potential impacts. This plan strengthens risk assessment work already being done both interstate and overseas. Key NGI biosecurity threats are detailed in threat summary tables (TSTs; Appendix 1, page 90), along with the plant pest threat priority list (the top ranked threats to the NGI).

The EPPRD outlines a mechanism whereby Industry and Government Parties will contribute to the total cost of a response to an EPP Incident based on agreed Categories. The process used for categorisation of EPPs is included in this section of the IBP, along with a list of NGI EPPs that have been categorised to date.

Risk mitigation plan

This section provides a summary of activities to mitigate the impact of pest threats on the Australian NGI, along with a set of guidelines for managing risk at all operational levels. Many pre-emptive practices can be adopted by plant industries and government agencies to reduce risks. These include:

- plant and vehicle movement restrictions
- surveillance activities
- awareness and training activities
- contingency planning
- development of diagnostic protocols and diagnostic capability

- production nursery biosecurity practices
- reporting suspect pests.

Contingency plans and response management

PHA has coordinated the development of PLANTPLAN, a generic emergency response plan for the Australian plant industries. This plan details the procedures required and the organisations responsible in the event of an incursion of an EPP. Pest-specific contingency plans may be developed as a result of the pest threats identified in this plan.

Review processes

With the support of the IBG, PHA is responsible for reviewing this plan on a 3-4 year basis. The review process will be used to determine:

- strategies to maximise the adoption of recommended practices
- where further improvements can be made
- revisions/updates to the plan
- where resources should be allocated to improve the plan.

Biosecurity implementation

The NGI IBP provides a framework for the implementation of biosecurity practices within the industry. Currently a range of biosecurity practices are undertaken within the NGI and these are outlined in the Risk Mitigation chapter (page 48). Further implementation within the framework of the IBP, such as those practices outlined in Figure 3, should be investigated to increase preparedness in the industry.

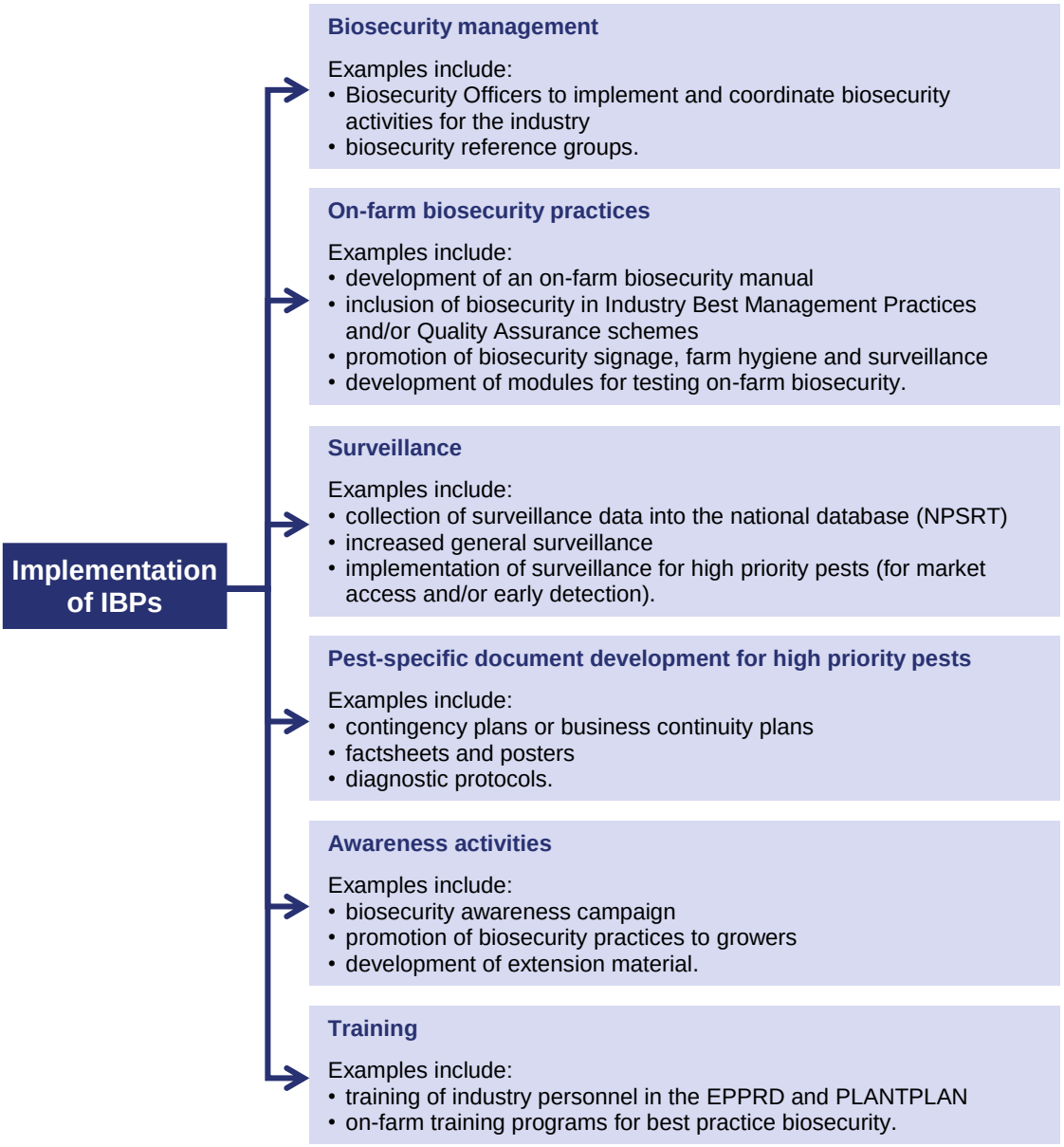

Figure 3. *Potential biosecurity implementation activities within the framework of the IBP*

Through the review of the NGI IBP, a list of biosecurity action items to be considered by stakeholders in the industry has been developed (Table 4). These items are listed within 'The Australian Nursery and Garden Industry's Policy Position on Quarantine and Biosecurity'. This list is intended to provide proposed or potential biosecurity priorities for the NGI that are gaps in the current activities listed in the Risk Mitigation section of the IBP. Future versions of this document will contain information on the progress made on the listed items.

Table 4. *Biosecurity action items identified by the nursery and garden industry*

Action item	Details	Timeline
Implement a national greenlife producer communication and information scheme	Investigate mechanisms to identify the location of all production nurseries in Australia to assist with biosecurity trace-back and trace-forward requirements and communication needs in the event of a pest incursion.	2016
Adopt the Nursery Production Farm Management System (NPFMS) as a market access instrument	The Australian NGI seeks recognition and support of its NPFMS (BioSecure *HACCP*) by all levels of government to assist with market access both domestically and internationally.	2014
Training in responsibilities for committee members and Industry Liaison Officers (ILOs)	At a committee level, a checklist of roles for individual committee members in the event of an incursion. At a regional level, identification and training of potential ILOs in EPPRD responsibilities and duties as an ILO should an incursion occur.	Ongoing with refresher training every 2 years
Development of general biosecurity awareness material	Development and provision of new awareness material for the identification of high priority pests (e.g. fact sheets, contingency plans and posters).	Ongoing as required
Development of on-farm biosecurity training packages	Training through the use of the on-farm biosecurity manual developed for the nursery production industry, fact sheets on high priority pests and stressing the importance of regular pest checks with records (and benefits to market access). On-farm training should also outline the owner reimbursement process to give growers confidence in the system and the desire to notify the State government agency if an incursion occurs.	Ongoing as required
Obtaining data on industry breakdown and farm-gate value of species groupings	Continue to pursue options for obtaining data on the state breakdown of nursery stock species groupings and farm-gate values. Investigate using label manufacturers to obtain this data. This information will enable an assessment of potential impacts of pest incursions on production nurseries on a state basis.	2013
Enhance uptake of the Nursery Production Farm Management System (FMS)	Enhance the uptake of FMS including the Nursery Industry Accreditation Scheme Australia (NIASA), EcoHort and BioSecure *HACCP* Best Management Practice programs.	Ongoing with year on year growth of 5%
Quarantine area establishment within production nurseries	Encourage the establishment of quarantine areas in production nurseries.	As required
Use of the National Plant Surveillance Reporting Tool (NPSRT)	Consider using NPSRT for capturing data from surveillance activities occurring within the industry.	Commence immediately

THREAT IDENTIFICATION, PEST RISK ASSESSMENTS AND CATEGORISATION

Introduction

This section identifies high risk exotic pest threats to the NGI, and presents a framework for assessing the potential economic, social and environmental impacts associated with each threat. This part of the biosecurity plan uses a nationally consistent and coordinated approach to threat identification and risk assessment to provide a strong base for future risk management in the NGI.

By identifying key threats a pre-emptive approach may be taken to risk management. Under this approach, mechanisms can be put into place to increase our response effectiveness if pest incursions occur. One such mechanism is the EPPRD that has been negotiated between PHA's government and industry members. The EPPRD ensures reliable and agreed funding arrangements are in place in advance of EPP incursions, and assists in the response to EPP incursions, particularly those identified as key threats.

Identification of high risk pests will also assist in the implementation of effective grower and community awareness campaigns, targeted biosecurity education and training programs for growers and diagnosticians and development of pest-specific incursion response plans.

Threat identification

Information on biosecurity threats to the NGI described in this document came from a combination of:

- past records
- existing industry protection plans
- relevant experience
- industry practice and experience
- relevant published literature
- local industry and overseas research
- specialist and expert judgment.

At this time, only invertebrate pests (insects, mites, molluscs and nematodes) and pathogens have been identified, although the issue of weeds may be revisited through future reviews of this plan.

Ranking pest threats

Key questions required for ranking the importance of pests include the following:

- What are the probabilities of entry into Australia, establishment and spread, for each pest?
- What are the likely impacts of the pest on cost of production, overall productivity and market access?
- How difficult is each pest to identify and control and/or eradicate?

The TSTs (Appendix 1) present a list of example plant pest threats to the NGI and provide summarised information on entry, establishment and spread potentials, as well as the economic consequences of establishment and eradication potential (where available). The most serious threats from the TSTs were identified through a process of qualitative risk assessment[5] and are listed in the HPP list (Table 5).

While there are similarities in the ranking system used in this document and the Import Risk Analysis (IRA) process followed by the Department of Agriculture, Fisheries and Forestry (DAFF), an important distinction is that this document considers all potential pathways by which an exotic pest could enter Australia, including illegal pathways and natural spread. The methods used here also provide different guidance to assignment of qualitative probabilities when compared with DAFF's IRA process. For further information refer to Pest risk assessments, page 39.

This document considers all potential pathways by which a pest might enter Australia, including natural and assisted spread (including smuggling). This is a broader view of potential risk than the IRA conducted by DAFF which focus only on specific regulated import pathways.

When a pest that threatens multiple industries is assessed, the entry, establishment and spread potentials take into account all known factors across all host industries. This accurately reflects the ability of a pest to enter, establish and spread across Australia and ultimately results in different industries, and their IBPs, sharing similar pest ratings. However the economic impact of a pest is considered at an industry specific level (i.e. for the NGI only in this IBP), and therefore this rating may differ between IBPs.

For the NGI, there are a number of pests that impact primarily on trade/market access rather than causing host mortality or yield loss. Some of these pests could potentially have a high

[5] An explanation of the risk assessment method used can be found on the PHA website (**www.planthealthaustralia.com.au/biosecurity/risk-mitigation**)

economic impact on the NGI by restricting the movement/trade of containerised plant material. These pests are included in the HPP list under the heading 'trade pests'.

Description of terms used in pest risk tables

The descriptions below relate to terms in Table 5, Table 6 and Table 7.

Life form legend

Bac	Bacteria
Bug	Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers (HEMIPTERA)
Fly	Flies and Midges (DIPTERA)
Fun	Fungi
Hym	Ants and wasps (HYMENOPTERA)
Lep	Butterflies and moths (LEPIDOPTERA)
Gast	Snails and slugs (GASTROPODA)
Mite	Mites e.g. spider and gall mites (ACARI)
Nem	Nematodes
Thri	Thrips (THYSANOPTERA)
Vir	Viruses

Entry potential

Negligible	The probability of entry is extremely low given the combination of factors including the geographic distribution of the pest, management practices applied, probability of pest survival in transit, pathways for pest entry and distribution to a suitable host.
Low	The probability of entry is low, but clearly possible given the expected combination of factors described above.
Medium	Pest entry is likely given the combination of factors described above.
High	Pest entry is very likely or certain given the combination of factors described above.
Unknown	The pest entry potential is unknown or very little of value is known.

Establishment potential

Negligible	The pest is unlikely to survive and become established within Australia due to a range of factors including, but not limited to, environmental conditions present in Australia and the distribution and prevalence of host plant species.
Low	The pest has the potential to survive and become established in approximately one-third or less of the range of hosts. The pest could have a low probability of contact with susceptible hosts.
Medium	The pest has the potential to survive and become established in between approximately one-third and two-thirds of the range of hosts.
High	The pest has potential to survive and become established throughout most or all of the range of hosts. Distribution is not limited by environmental conditions that prevail in Australia. Based upon its current world distribution, and known conditions of survival, it is likely to survive in Australia wherever major hosts are grown.
Unknown	The establishment potential of the pest is unknown or very little of value is known.

Spread potential

Negligible	The pest has very limited potential for spread through a localised region of Australia.
Low	The pest has potential for spread through a localised region of Australia.
Medium	The pest has potential for spread throughout a physiographic region.
High	The pest has potential for spread to all production areas.
Unknown	The spread potential is unknown or very little of value is known.

Economic impact

Negligible	There is no measureable impact on yield, host longevity, production costs, storage or market access.
Low	There is minor impact on standing crop, stored product or market access.
Medium	There is moderate impact on crops, but host mortality is rare, and storage losses and/or moderate impacts on market access may occur.
High	There is severe impact on standing crop, with significant host mortality and/or storage losses and/or severe impacts on market access.
Extreme	There is extreme impact on standing crop, with extreme host mortality and/or storage losses and/or extreme impacts on market access.
Unknown	The economic potential of the pest is unknown or very little of value is known.

Nursery and garden industry high priority plant pest threat list

Table 5 provides an overview of the top ranked threats to the NGI. Further details on each pest along with the basis for the likelihood ratings are provided in the TSTs (Appendix 1). Assessments may change given more detailed research, and the priority list will be reviewed with the Biosecurity Plan on a 3-4 year basis. An explanation of the method used for calculating the overall risk can be found on the PHA website[6].

Table 5. *Nursery and garden industry high priority plant pest threat list*

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
INVERTEBRATES									
Cotton aphid	Bug	*Aphis gossypii* (exotic strains)[7]	Very broad host range including cotton, papaya, citrus, capsicum, melon, cucumber, pumpkin, carnation, sunflower, jasmine, lettuce, lychee, macadamia, apple, passionfruit, avocado, tomato, potato, maize, Asteraceae, Myrtaceae, Ranunculaceae and roses	Leaves, inflorescence, stems	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[6] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

[7] Exotic strains may have different insecticide resistance profiles or cause differing levels of damage than strains already in Australia

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Silverleaf whitefly	Bug	*Bemisia tabaci* (exotic strains)[8]	Broad host range across vegetables and ornamentals including chrysanthemum and poinsettia. Vectors over 60 viruses[9].	Leaves, stems	MEDIUM	HIGH	HIGH	MEDIUM - HIGH[10]	**MEDIUM - HIGH**
Poinsettia thrips[11]	Thri	*Echinothrips americanus*	Broad host range across ornamental plants, especially Araceae and Balsaminaceae	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Glassy-winged sharpshooter	Bug	*Homalodisca vitripennis*[12]	Very broad host range including citrus, crape myrtle, *Prunus* spp., blackberry, bottlebrush, bougainvillea, camellia, acacia, daylily, dianthus, chrysanthemum, macadamia, pistachio and grapevine. Host lists continue to grow, primarily within ornamental plant spp.	Leaves, stems	MEDIUM[13]	HIGH	HIGH	MEDIUM - HIGH[14]	**MEDIUM - HIGH**[15]
Serpentine leaf miner[16]	Fly	*Liriomyza huidobrensis*	Wide range of vegetable crops including eggplant, onion, potato, celery, gourd, lettuce and chrysanthemum	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[8] Recently published information suggests exotic strains might actually be different species for which taxonomic differentiation has not yet been established (Tay WT, Evans GA, Boykin LM and De Barro PJ. 2012, Will the real *Bemisia tabaci* please stand up? *PlosOne* 7(11): e50550). It is now considered that there is sufficient biological, behavioural and molecular genetic data to support it being a cryptic species complex composed of at least 34 morphologically indistinguishable species.

[9] Genera include Begomovirus, Closterovirus, Nepovirus, Carlavirus and Potyvirus. Begomoviruses (Whitefly-transmitted geminiviruses) are the most important of these agriculturally, causing yield losses to crops of between 20 and 100% (Brown JK, Bird J, 1992. Whitefly-transmitted geminiviruses and associated disorders in the Americas and the Caribbean Basin. *Plant Disease*, 76(3): 220-225).

[10] Economic impact high in the presence of vectored viruses

[11] Synonym: Banded greenhouse thrips

[12] Synonym: *Homalodisca coagulata*

[13] Entry via host-plant for plantings, cutflowers, branches and fruits

[14] Economic impact high if vectoring viruses and/or *Xylella fastidiosa.*

[15] Overall risk high if vectoring viruses and/or *Xylella fastidiosa*

[16] Synonyms: Vegetable leaf miner, Potato leaf miner, Pea leaf miner

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Tarnished plant bug	Bug	*Lygus lineolaris*[17]	Broad host range including vegetables, strawberry, peach, crimson clover, aster, chrysanthemum, dahlia and impatiens	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Southern red mite	Mite	*Oligonychus ilicis*	Azalea, camellia, holly, boxwood, eucalyptus, oak, walnut, camphor laurel, rice, quince, cotoneaster, loquat, strawberry, pear, coffee and rhododendron	Leaves	HIGH[18]	MEDIUM	HIGH	MEDIUM	**MEDIUM**
PATHOGENS									
Huanglongbing (Asiatic strain)[19]	Bac	*Candidatus* Liberibacter asiaticus[20]	Citrus[21], mandarin, sweet orange, tangelo, sour orange, trifoliate orange, navel orange, lime, lemon, kumquat, grapefruit, Australian native citrus, *Atalantia* spp., *Murraya* spp. *Clausena* spp., *Vepris* spp. and other rutaceous plants including ornamentals	Leaves, stems, flowers, fruit, roots, whole plant	MEDIUM - HIGH[22]	HIGH[23]	HIGH[23]	MEDIUM	**MEDIUM**

[17] Entry on glasshouse ornamental plants for plantings and cutflowers
[18] Detected in Sydney in late 1990s and was eradicated
[19] Synonym: Citrus greening
[20] Vectored by the Asian citrus psyllid (*Diaphorina citri*)
[21] Huanglongbing can affect almost all citrus cultivars; relatives like sweet orange, tangelo and mandarin are the most susceptible, while lime, lemon, sour orange and trifoliate orange are the least susceptible
[22] Entry potential high on illegal budwood and in the presence of the Asian citrus psyllid vector (*Diaphorina citri*). The Asiatic strain is the most widespread of the Liberibacter species. Its presence in locations of close proximity to Australia (Indonesia, East Timor and Papua New Guinea) increases the probability of entry of this strain compared to the African and American strains.
[23] Establishment and spread potentials high in the presence of the Asian citrus psyllid vector (*Diaphorina citri*)

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sudden oak death	Fun	*Phytophthora ramorum*	Broad host range across 70 genera from 33 families including oak trees, *Arbutus*, *Lithocarpus* spp., fir, maple plants in *Ericaceae* family, *Eucalyptus gunnii*, beech, bay laurel, magnolia and yew. The known host range is broad and continues to expand with more research.	Stems, branches, leaves	MEDIUM	HIGH	HIGH	HIGH - EXTREME	**HIGH - EXTREME**
Bacterial canker	Bac	*Pseudomonas syringae* pv. *syringae* (exotic races)[24]	Broad host range including onion, leek, capsicum, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, lucerne, rice, passionfruit, avocado, bean, poplar, stonefruit, azalea, roses, tomato, willows, clover, blueberries, grapevine and maize	Leaves, inflorescence, stems, pods, seeds, flowers, fruit	HIGH	HIGH	HIGH	MEDIUM - HIGH	**MEDIUM - HIGH**
Guava/ Eucalyptus rust	Fun	*Puccinia psidii* sensu lato (exotic variants)[25]	Myrtaceae	Leaves, shoots	HIGH	HIGH	HIGH	HIGH	**HIGH**
Whitefly-transmitted viruses	Vir	Whitefly-transmitted viruses[26]	Collectively a wide range of vegetables & nursery stock	Leaves, whole plant (stunting)	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Example: Lettuce infectious yellows virus		Example: *Lettuce infectious yellows virus*[27]	Example: Lettuce, beetroot, marrow, melon, carrot, cucurbits, watermelon and weeds including morning glory, *Helianthus* spp., *Lactuca canadensis*, small flowered mallow (*Malva parviflora*) and *Physalis heterophylla*						

[24] Exotic races may be more virulent than those currently present in Australia

[25] Several variants that belong to the *Puccini psidii* sensu lato rust complex exist outside of Australia

[26] Includes some viruses belonging to the Geminiviridae and Closteriviridae families

[27] Transmitted by the whitefly *Bemisia tabaci* (present in Australia)

Common name	Life form	Scientific name	Primary host	Plant part affected	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Pierce's disease[28]	Bac	*Xylella fastidiosa* (exotic strains)[29]	Broad host range including ryegrass, maples, pecan, citrus, coffee, lucerne, oleander, sycamore, almond, peach, pear, Japanese plum, oak, blackberry, raspberry and grapevine	Whole plant	Ratings with vector[30] MEDIUM	MEDIUM	HIGH	HIGH	**MEDIUM**
TRADE PESTS (Impact on market access by restricting the movement of potted plant material)									
Giant African snail	Gast	*Achatina fulica*	Broad host range including groundnut, *Brassica* spp., papaya, melon, ornamental gourd, carrot, white yam, banana and cocoa	Whole plant	HIGH	HIGH	MEDIUM - HIGH	HIGH[31]	**HIGH**
Asian citrus psyllid	Bug	*Diaphorina citri*[32]	Citrus spp. and citrus relatives; *Atalantia*, *Citropsis*, *Limonia*, *Murraya*, *Bergera* and *Clausena*	Fruit, flowers, leaves, stem	MEDIUM - HIGH	HIGH	HIGH	MEDIUM[33]	**MEDIUM**
Asian gypsy moth	Lep	*Lymantria dispar*	Extensive range of tree spp. including maples, oaks, elms, box elder, birches, chestnut, red gum, *Pinus* spp., *Prunus* spp., corn, apple and pear	Leaves, flowers	MEDIUM - HIGH	MEDIUM	HIGH	HIGH[34]	**MEDIUM - HIGH**
Golden apple snail	Gast	*Pomacea canaliculata*	Rice, taro, *Azolla* spp., wild rice (*Zizania* spp.)	Leaves, stems	HIGH	HIGH	HIGH	MEDIUM - HIGH[34]	**MEDIUM - HIGH**

[28] Vectored by the Glassy-winged sharpshooter, *Homalodisca vitripennis* and other insects that belong to the spittlebug/ froghopper family (Cercopidae)

[29] There are multiple exotic strains of *Xylella fastidiosa* that are ususally based on pathogenicity and/or gene sequence. Strains appear to be host specific. For example, stonefruit infecting isolates tend to only infect stonefruit and likewise with pear, citrus and other crops.

[30] For further information on ratings refer to the Pierce's disease contingency plan available through the Pest Information Documents Database at **www.planthealthaustralia.com.au/pidd**

[31] Predominant impact to NGI is on market access rather than causing host mortality or yield loss

[32] Vectors Huanglongbing (Asiatic and American strains)

[33] Economic impact medium if vectoring Huanglongbing. Predominant impact to NGI is on market access rather than causing host mortality or yield loss.

[34] Predominant impact to NGI is on market access rather than causing host mortality or yield loss

Current resources for detection and identification of high priority pests

Diagnostic and surveillance capacity for the HPPs of the NGI (Table 5) supports Australia's preparedness and ability to respond to them should they be detected. A summary of this capacity is shown in Table 6, which lists the formal active surveillance programs and the status of national diagnostic protocols developed for each of the NGI HPPs.

Development of national diagnostic protocols is managed through the Subcommittee on Plant Health Diagnostic Standards (SPHDS). While diagnostic capacity may exist in Australia in the absence of these documents, an endorsed national diagnostic protocol provides a consistent and agreed diagnostic approach for identifying new pests. Further information on these documents can be found on page 87.

Table 6. *Diagnostic protocols and surveillance programs for high priority pests*[35]

Common name	Life form	Scientific name	National diagnostic protocol	Surveillance programs
Giant African snail	Gast	*Achatina fulica*	Not developed	NAQS pest and disease survey DPIF NT surveillance NSW DPI Urban hazard site surveillance
Cotton aphid	Bug	*Aphis gossypii* (exotic strains)	Not developed	None known at present
Silverleaf whitefly	Bug	*Bemisia tabaci* (exotic strains)	Lucid key[36]	DPIF NT Silverleaf whitefly surveillance DPIPWE Tas Sticky trap survey PIRSA Silverleaf whitefly surveillance
Huanglongbing (Asiatic strain)[37]	Bac	*Candidatus* Liberibacter asiaticus	Draft	NAQS Pest and disease survey PIRSA Citrus greening surveillance
Asian citrus psyllid	Bug	*Diaphorina citri*	Draft	NAQS Pest and disease survey
Poinsettia thrips[38]	Thri	*Echinothrips americanus*	Endorsed	NAQS Pest and disease survey

[35] Information presented has been taken from the National Plant Health Status Report 2011 and confirmed or updated through either Plant Health Committee, the Subcommittee on Plant Health Diagnostic Standards, the Subcommittee on National Plant Health Surveillance or other stakeholders

[36] A lucid key is an interactive matrix comprising a list of entities and a list of features and states describing or otherwise associated with them, score data relating the feature states to the entities, and various images and/or HTML pages attached to the features, states and/or entities

[37] Synonym: Citrus greening

[38] Synonym: Banded greenhouse thrips

Common name	Life form	Scientific name	National diagnostic protocol	Surveillance programs
Glassy-winged sharpshooter	Bug	*Homalodisca vitripennis*[39]	Draft	NSW DPI Urban hazard site surveillance
Serpentine leaf miner[40]	Fly	*Liriomyza huidobrensis*	Draft	NAQS Pest and disease survey
Tarnished plant bug	Bug	*Lygus lineolaris*	Not developed	None known at present
Asian gypsy moth	Lep	*Lymantria dispar*	Draft	DAFF National Asian gypsy moth trapping program NSW Urban hazard site surveillance PIRSA Asian gypsy moth surveillance
Southern red mite	Mite	*Oligonychus ilicis*	Not developed	None known at present
Sudden oak death	Fun	*Phytophthora ramorum*	Endorsed	None known at present
Golden apple snail	Gast	*Pomacea canaliculata*	Draft	None known at present
Bacterial canker	Bac	*Pseudomonas syringae* pv. *syringae* (exotic races)	Not developed	None known at present
Guava/Eucalyptus rust	Fun	*Puccinia psidii* sensu lato (exotic variants)[41]	Draft	NAQS Pest and disease survey DAFWA, DECWA Myrtle rust surveillance[42] DPI Vic Myrtle rust Exotic plant pest response[42] DPIPWE Tas Myrtle rust survey[42] PIRSA Myrtle and Eucalyptus rust surveillance[42] DPIF NT surveillance
Whitefly-transmitted viruses **Example: Lettuce infectious yellows virus**	Vir	White fly-transmitted viruses Example: *Lettuce infectious yellows virus*	Not developed	None known at present
Pierce's disease	Bac	*Xylella fastidiosa*	Endorsed	DAFWA HortGuard passive surveillance

[39] Synonym: *Homalodisca coagulata*
[40] Synonyms: Vegetable leaf miner, Potato leaf miner, Pea leaf miner
[41] Several variants that belong to the *Puccini psidii* rust complex exist outside of Australia
[42] Surveillance for Myrtle rust (present in Eastern Australia) is likely to pick up exotic variants of *Puccinia psidii*

Pests of limited distribution

Table 7 provides details on priority pests of the NGI that are currently present in Australia and have limited distribution[43]. This list will be reviewed with the IBP.

Table 7. *Pests identified as priorities that are of limited distribution within Australia*

Common name	Life form	Scientific name	Hosts	Plant part affected	Distribution in Australia	Comments
Spiralling whitefly	Bug	*Aleurodicus dispersus*	Very broad host range; recorded from 38 genera in 27 families including many horticultural crops and an extensive range of ornamentals and shade trees	Leaves, fruit	Qld, NT	Established in tropical coastal Queensland from Torres Strait to Gladstone. Also present in the NT from Darwin to Pine Creek. Major impact for the NGI is on trade with restrictions on movement of containerised plants.
Yellow crazy ant	Hym	*Anoplolepis gracilipes*	Broad host range[44]; obtains carbohydrates and amino acids from plant nectaries and honeydew excreted by Hemiptera which it tends on stems and leaves of a wide variety of tree and shrub species	Leaves, fruit, whole plant[45]	Qld, NT	Widely regarded as an environmental pest and one of the world's 100 most worst invasive species. The yellow crazy ant is present in one small area of East Arnhem Land, NT. This population is under an official control program with ongoing delimiting surveillance and active management. It was first detected in Qld in 2001 in Cairns and infestations have been since found and treated in Brisbane, the Gold Coast, Caboolture, Hervey Bay, Pinkenba and Townsville. Most commonly transported inside sea cargo and regularly detected and eradicated by DAFF Biosecurity in port areas. Major impact for the NGI is on trade with restrictions on movement of containerised plants.

[43] Note that this list is not exhaustive. It contains example pests of limited distribution that are of concern to the NGI.

[44] Coffee, cacao, coconut, citrus and cinnamon plantations readily invaded. In Australia, the presence of Acacias and other plants that supply extra-floral carbohydrates appears to be a primary influence on persistence. In addition, the species can colonise relatively undisturbed habitats and urban areas.

[45] Main effect on plants is through protection of sap sucking insects such as scales and mealy bugs which can lead to population outbreaks of the insect pests, severely damaging the plants they feed on.

Common name	Life form	Scientific name	Hosts	Plant part affected	Distribution in Australia	Comments
Grapevine phylloxera	Bug	*Daktulosphaira vitifoliae*	*Vitis* spp.	Roots, leaves	NSW, Vic	First detected in Australia in 1877, in Geelong Vic and discovered in NSW in 1884 at Camden. Until recently, it was confined to small areas in Central Vic (Nagambie, Upton, Mooroopna) and North East Vic (Rutherglen, King Valley), in South East NSW (Corowa) and in Camden and Cumberland near Sydney. However, there have been several detections in central Vic in the past 10 years. Vic has established Phylloxera Exclusion Zones (PEZs), which have been surveyed and are declared to be free of phylloxera, Phylloxera Infested Zones (PIZs) in which the pest has been detected, and Phylloxera Risk Zones (PRZs), which have an undetermined Phylloxera status because they have not been surveyed[46]. NSW has established a PIZ in Albury/Corowa and in the Greater Sydney Region. The rest of NSW is declared a PEZ, including many new and developing wine regions of the state. Queensland has established a PEZ in the major table grape production districts of Emerald, Mundubbera and St George. Major impact for the NGI is on trade with restrictions on movement of grapevine plant material.
Potato cyst nematode (PCN)	Nem	*Globodera rostochiensis*	*Solanum* spp. including tomato, potato and eggplant	Leaves, roots, whole plant	Vic	Established in parts of Vic and has been eradicated from WA. Vic has established PCN management zones. These include Potato/Plant Protection Districts (PPDs) around the districts of Corryong, Warragul, Colac-Otway, Portland and Toolangi. Four Control Areas have also been declared to prevent the spread of PCN from the areas of Thorpdale, Gembrook, Koo Wee Rup and Wandin. PCN has also been detected in metropolitan areas. Major impact for the NGI is on trade with restrictions on the movement of nursery stock.
Green snail	Gast	*Cantareus apertus*[47]	Broad host range; cabbage, cauliflower, lettuce, pea, bean, wheat, lupin, pasture grasses and natives	Leaves	WA, Vic	Became established in the Perth metropolitan area in the 1980s. Detected in Victoria for the first time in September 2011, near Cobram in the north of the state. A restricted area has been declared around the infestation near Cobram. Major impact for the NGI is the restrictions on movement of nursery stock.

[46] For further information and maps of PIZs and PEZs, see **www.dpi.vic.gov.au/agriculture/horticulture/wine-and-grapes/Viticulture-biosecurity**

[47] Synonym: *Helix aperta*

Common name	Life form	Scientific name	Hosts	Plant part affected	Distribution in Australia	Comments
Red Imported Fire Ant (RIFA)	Hym	*Solenopsis invicta*	Broad host range; potato, okra, sunflower, citrus, pecan, watermelon, strawberry, soyabean, cabbage, pines, nightshade, sorghum, eggplant, corn, turfgrass, cotton and passionfruit	Seeds, fruit, seedlings	Qld	First discovered at two separate sites in Brisbane in February 2001 and currently under eradication. The whole of Queensland has been declared a quarantine area to prevent RIFA spreading in the State and to eradicate it in the State. In addition a RIFA restricted area for soil disturbance and movement of high-risk materials within Queensland currently exists around the city of Brisbane, the bordering cities of Ipswich and Logan, the Scenic Rim and a small portion of Redlands Shire. A restricted area for movement of high-risk materials interstate has also been established around Brisbane, Ipswich and Logan[48]. Major impact for the NGI is on trade with restrictions on movement of containerised plants.
Melon thrips	Thri	*Thrips palmi*	Broad host range; onion, capsicum, eggplant, chrysanthemum, citrus, cucurbits, leguminous plants, sunflower, cotton, lettuce, orchids, mango, avocado and *Solanum* spp.	Leaves, growing points, fruit	NT, Qld	Detected in 1989 in NT around Berrimah and Darwin's rural area. Detected in Qld in 1993 and since found in various parts of North East and South East Qld. Major impact for the NGI is on trade with restrictions on movement of Melon thrips host plants and plant material.
Tomato yellow leaf curl virus (TYLCV)	Vir	*Tomato yellow leaf curl virus*[49]	Tomato, capsicum, *Lisianthus*, petunia, common bean, *Physalis philadelphica*, morning glory, cowpea and black nightshade	Leaves, stems, whole plant	Qld	In March 2006, tomato leaf curl disease was found in cherry tomato crops in the south and west periphery of Brisbane. In April 2006, infected plants were also found around Bundaberg. By June 2007, the virus was present in the Lockyer Valley, Fassifern Valley, Esk, Caboolture and Redlands areas. Since 2009 it has become a serious production constraint around Bundaberg. In February 2011, it was found in backyard tomato plants in Mareeba on the Atherton Tablelands. Major impact for the NGI is on trade with restrictions on movement of TYLCV host plants and plant material.

[48] For further information on RIFA and maps of restricted areas see the DAFF Queensland website **www.dpi.qld.gov.au/4790_7502.htm**

[49] Vectored by Silverleaf whitefly (*Bemisia tabaci*) that is known to occur in Qld, NSW, NT and WA

Common name	Life form	Scientific name	Hosts	Plant part affected	Distribution in Australia	Comments
Myrtle rust	Fun	*Uredo rangelii*[50]	Over 100 known naturally susceptible host species including willow myrtle, tea tree, bottle brush and turpentine[51]	Leaves	NSW, Qld, Vic	Initial detection in April 2010 occurred on the NSW Central Coast on a stand of *Agonis flexuosa* (willow myrtle) grown for the cut flower market. In the early stages secondary detections were observed on *Syncarpia glomulifera* (turpentine) and *Callistemon* (bottlebrush). First detected in Qld in late 2010. Currently widely spread in South East, Central and Far North Qld and has been detected in several council areas[52]. Detected in Vic in late 2011 and declared an endemic disease on 30 June. Detected at more than 60 sites, mainly at production nurseries and wholesale outlets in and around metropolitan Melbourne. Major impact for the NGI is on trade with restrictions on movement of myrtle rust host plants (Myrtaceae) and plant material.
Little fire ant[53]	Hym	*Wasmannia auropunctata*	No specific hosts, however vectors disease to agricultural crops. Also enhances populations of honey-dew producing Hemiptera.	Whole plant	Qld	First discovered in Smithfield in May 2006, and later detected in Kewarra Beach, Trinity Beach, Caravonica and Redlynch in Cairns in Far North Queensland. More recently, the ants have been detected in Yorkeys Knob, Kamerunga, Kuranda, Smithfield, Craiglie/Port Douglas, Freshwater and Bingil Bay near Mission Beach. Biosecurity Queensland is working with the community to eradicate this pest. It is continuing to undertake treatment rounds and post-treatment surveillance in all infested areas. Major impact for the NGI is on trade with restrictions on movement of containerised plants as this is one mechanism of electric ant spread.

[50] Myrtle rust is a taxon within the *Puccinia psidii sensu lato* rust complex

[51] Number of hosts is expected to rise with further research

[52] For the full list of council areas in which Myrtle rust has been detected see **www.daff.qld.gov.au/4790_19788.htm**

[53] Synonym: Electric ant

Pest risk assessments

The assessment process used in this IBP was developed in accordance with the International Standards for Phytosanitary Measures (ISPM) No. 2 and 11 [Food and Agriculture Organization of the United Nations (FAO), 2004; 2007]. A summary of the pest risk analysis protocol followed in this IBP is shown in Table 8, and the complete protocol used for pest risk analysis in this IBP can be found on the PHA website[54].

While there are similarities in the ranking system used in this document and the IRA process followed by DAFF, there are differences in the underlying methodology and scope of consideration that may result in different outcomes between the two assessment systems. This includes different guidance to assignment of qualitative probabilities when compared with DAFF's IRA process. Modifications of the Biosecurity Australia (2009) protocol have been made to suit the analysis required in the IBP development process, including, but not limited to:

- **Entry potential:** The determination of entry potential in this IBP takes into account multiple possible pathways for the legal importation of plant material as well as illegal pathways, contamination and the possibility of introduction through natural means such as wind. Therefore the scope is wider than that used by DAFF in their IRA process, which only considers legal importation of plants or plant commodities.
- **Potential economic impact** of pest establishment in this document only takes into account the impacts on the NGI. The DAFF IRA process has a wider scope, including the effects to all of Australia's plant industries, trade, the environment and public health.
- **Risk potentials and impacts:** The number of categories used in this IBP for describing the entry, establishment, spread, and potential economic impact (see Description of terms used in pest risk tables, page 26) differs in comparison to that used in Biosecurity Australia (2009).

[54] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

Table 8. *Summary of pest risk assessment process used in IBPs*

Step 1	Clearly identify the pest	• Generally pest defined to species level • Alternatively a group (e.g. family, genus level) can be used • Sub-species level (e.g. race, pathovar, etc.) may be required
Step 2	Assess entry, establishment and spread likelihoods	• Assessment based on current system and factors • Negligible, low, medium, high or unknown ratings
Step 3	Assess likely consequences	• Primarily based on likely economic impact to industry based on current factors • Negligible, low, medium, high, extreme or unknown ratings
Step 4	Derive overall risk	• Entry, establishment and spread likelihoods are combined to generate a likelihood score • Likelihood score combined with the likely economic impact to generate an overall risk score
Step 5	Review the risk	• Risk ratings should be reviewed with the IBP

The objective of risk assessment is to clearly identify and classify biosecurity risks and to provide data to assist in the evaluation and treatment of these risks. Risk assessment involves consideration of the sources of risk, their consequences, and the likelihood that those consequences may occur. Factors that affect the consequences and likelihood may be identified and addressed via risk mitigation strategies.

Risk assessment may be undertaken to various degrees of refinement, depending on the risk information and data available. Assessment may be qualitative, semi-quantitative, quantitative or a combination of these. The complexity and cost of assessment increase with the production of more quantitative data. It is often more practical to first obtain a general indication of the level of risk through qualitative risk assessment, and if necessary, undertake more specific quantitative assessment later [Australian Standard/New Zealand Standard (AS/NZS)-4360, 1999].

Formal Categorisation of pests for inclusion in the Emergency Plant Pest Response Deed

The following section outlines the EPPRD between all government and most industry members of PHA. The EPPRD aims to manage the impact of EPPs by establishing an industry/government agreement to cover eradication of emergency pests, reducing delays in

securing funding, providing industry with greater involvement in eradication efforts and removing disincentives to report emergency pests. NGIA is the peak body for the Australian NGI and became a member of PHA (and a signatory to the EPPRD) in May 2005.

The EPPRD only covers eradication responses to EPPs when based on an approved EPP Response Plan. Weeds are not covered by the EPPRD at this stage. Under the EPPRD, both industry and government contribute to the total cost of an approved EPP Response with the ratio of contribution based on the Category of the EPP (Table 9). The Category of the EPP is determined by the Categorisation Group and is based on the relative public versus private benefits of eradication of the EPP.

A copy of the EPPRD can be downloaded from the PHA website (**www.planthealthaustralia.com.au/epprd**).

Pest categorisation

The EPPRD outlines a mechanism whereby Industry and Government Parties will contribute to the total cost of a response to an EPP Incident based on agreed Categories. These Categories determine the ratio each party will pay, based on the relative public and private benefits of EPP eradication. Four Categories are included in the EPPRD, as outlined in Table 9 and Figure 4.

Categorisation of a pest is carried out to determine the Parties that are most affected and who will therefore be the beneficiaries of an eradication response. It does not indicate its likelihood of eradication or its overall importance i.e. a pest listed as Category 1 is not deemed to be any more or less important than a pest listed as Category 4.

Pests listed in the HPP threat list (Table 5) may be put forward for categorisation and inclusion in Schedule 13 of the EPPRD. Other pests identified in TSTs or identified via other means as being priority pests, may also be categorised if required. The process for requesting categorisation of a pest is set out in Schedule 3 of the EPPRD.

Pests that enter Australia, but which have not been formally categorised will be treated as belonging to Category 3 until an appropriate Category has been formally determined.

The Categorisation Group will be responsible for determining a cost sharing Category applicable for HPPs. Only pests meeting the EPP criteria will be considered for categorisation. Taking into account relevant scientific and other knowledge and experience, the Categorisation Group will consider requests for pest categorisation, re-categorisation or

removal from Schedule 13 of the EPPRD. Figure 4 outlines the decision-making process used by the Categorisation Group in deciding pest Categories.

When more than one industry is affected by an EPP, the Categorisation Group will also determine, and when requested, will review the Funding Weight for each industry. Funding Weights provide a means for calculating each industry's Proportional Share of the total industry contribution if a pest affects multiple Industry Parties.

Composition of the Categorisation Group

As described in Part 4 of Schedule 8 of the EPPRD, the membership of the Categorisation Group for each industry will comprise (at a minimum):

- an independent chair from PHA
- a standing representative of Industry Parties
- three technical experts [people with specific expertise in the areas of plant pathology or entomology], one nominated by the Australian Government, one nominated by the states/territories and one nominated by plant industry(s)
- a person with relevant economic expertise including social, trade and regional impact assessment
- a nominee from each plant industry or industries affected by the exotic plant pest being categorised.

The Categorisation Group may also seek advice from:

- a person with human health expertise, if a public health risk may exist
- a conservation representative (e.g. Australian Government Department of Environment and Heritage) or
- other relevant members determined by the independent chair.

Advisers who have specific expertise may accompany members of the Categorisation Group, but will not be part of the decision-making process.

Table 9. *Cost sharing categories*

Category	Description	Funding share
Category 1: Very high public benefits	Pest which if not eradicated would: • cause major environmental damage to natural ecosystems; and/or • potentially affect human health or cause a major nuisance to humans; and/or • cause significant damage to amenity flora; and • have relatively little impact on commercial crops. • This category also covers situations where the pest has a very wide range of hosts including native flora and there is considerable uncertainty as to the relative impacts on the different crops. In short, it is almost impossible to properly determine which industries benefit from eradication and to what extent, and in any case, the incursion primarily affects native flora and/or amenity plants, and/or is a major nuisance if not a health risk to humans.	100% Government
Category 2: High public benefits	Pest which if not eradicated would: • cause significant public losses either directly through serious loss of amenity and/or environmental values and/or effects on households or indirectly through very severe economic impacts on regions and the national economy, through large trade losses with flow on effects through the economy; and • also impose major costs on the industries concerned so that these industries would significantly benefit from eradication.	80% Government 20% Industry
Category 3: Moderate public benefits	Pest which if not eradicated would: • primarily harm the industries concerned but there would also be some significant public costs as well (that is, moderate public benefits from eradication). In this case the pest could adversely affect public amenities, households or the environment, and/or could have significant, though moderate trade implications and/or national and regional economic implications.	50% Government 50% Industry
Category 4: Mostly if not wholly private benefits	Pest which if not eradicated would: • have little or no public cost implications and little or no impacts on natural ecosystems. The affected commercial industries would be adversely affected primarily through additional costs of production, through extra control costs or nuisance costs; and • generally there would be no significant trade issues that would affect national and regional economies.	20% Government 80% Industry

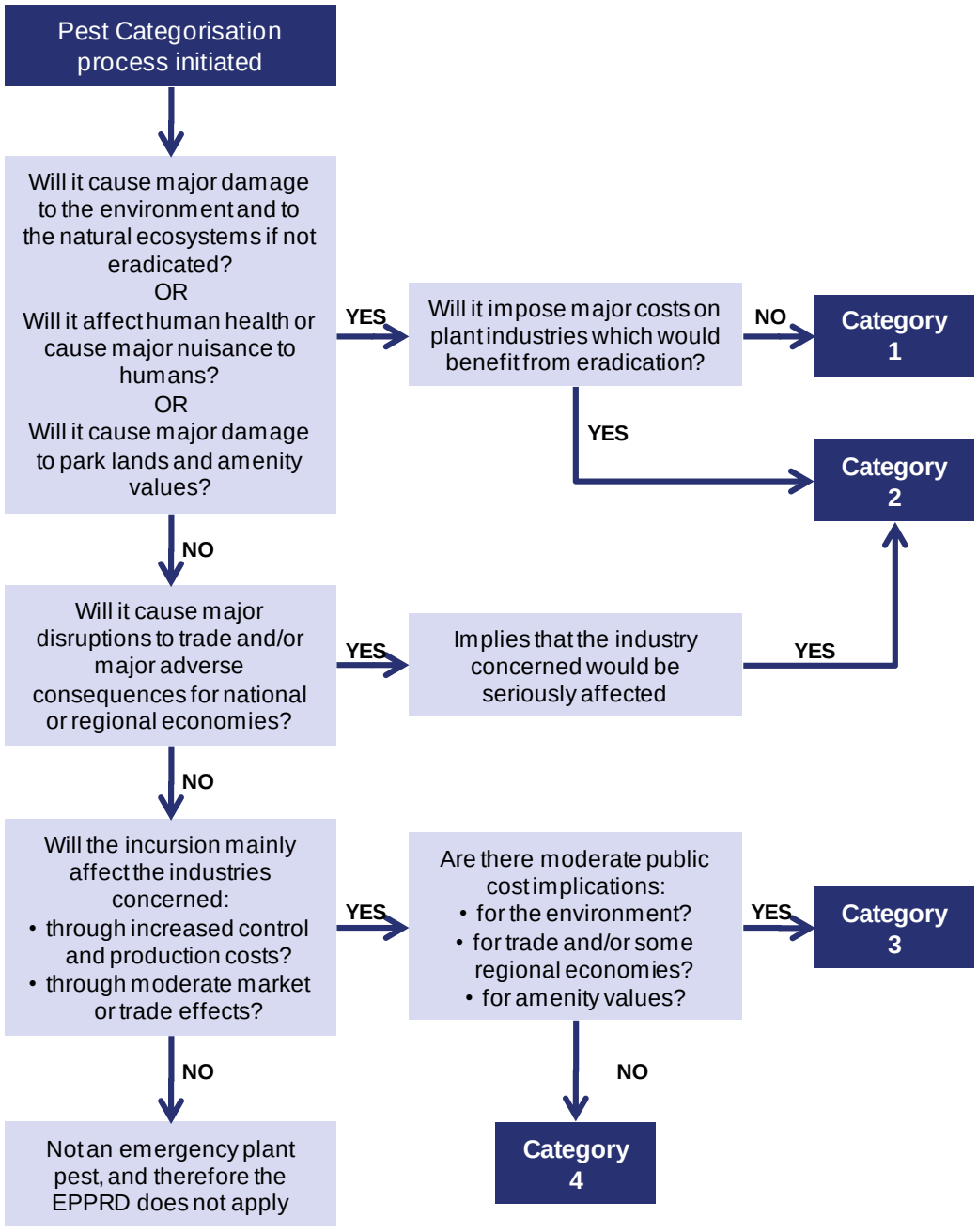

Figure 4. *Summarised pest categorisation decision tree*

Nursery and garden industry Emergency Plant Pests categorised to date

EPPs for the NGI that have received formal pest categorisation (included within Schedule 13 of the EPPRD) are listed in Table 10. For the latest version of Schedule 13, refer to the EPPRD version found at **www.planthealthaustralia.com.au/epprd**.

Table 10. *Formal categories for pests of the nursery and garden industry as listed in the EPPRD (as at January 2013)*

Common name	Scientific name	Formal Category
Strawberry tortrix	*Acleris comariana*	4
Summer fruit tortrix	*Adoxophyes orana*	2
Navel orangeworm	*Amyelois transitella*	3
Filbert blight	*Anisogramma anomala*	3
Black knot	*Apiosporina morbosa*	3
Tomato/potato psyllid	*Bactericera cockerelli*	3
Huanglongbing (Asiatic strain)	*Candidatus* Liberibacter asiaticus	2
Zebra chip	*Candidatus* Liberibacter psyllaurous	2
Dutch elm disease	*Ceratocystis ulmi*	1
Camellia petal blight	*Ciborinia camelliae*	3
Ring rot	*Clavibacter michiganensis* subsp. *sepedonicus*	3
Plum weevil	*Conotrachelus nenuphar*	2
Chestnut blight	*Cryphonectria parasitica*	2
False codling moth	*Cryptophlebia leucotreta*	2
Grape phylloxera type B	*Daktulosphaira vitifoliae* (biotype B)	3
Asian citrus psyllid	*Diaphorina citri*	3
Fire blight	*Erwinia amylovora*	2
European stone fruit yellows	*European stone fruit yellows phytoplasma*	3
Potato cyst nematode	*Globodera rostochiensis*	3
Colorado potato beetle	*Leptinotarsa decemlineata*	3
American leafminer	*Liriomyza sativae*	3

Common name	Scientific name	Formal Category
Western plant bug	*Lygus hesperus*	4
Brown rot	*Monilinia fructigena*	3
Variegated cutworm	*Peridroma saucia*	4
Texas root rot	*Phymatotrichopsis omnivora*	2
Sudden oak death	*Phytophthora ramorum*	1
Red steele root rot	*Phytophthora fragariae* var. *fragariae*	3
Plum pox virus	*Plum pox virus (Potyvirus)*	2
Golden apple snail	*Pomacea canaliculata*	2
Potato spindle tuber viroid	*Potato spindle tuber viroid (Pospiviroidae)*	3
Bacterial wilt	*Ralstonia solanacearum* race 2	2
Spider mite	*Tetranychus piercei*	4
Myrtle rust	*Uredo rangelii*[55]	1
Verticillium wilt	*Verticillium dahliae* (defoliating strain)	3
X disease	*X disease phytoplasma*	3
Citrus canker	*Xanthomonas citri* subsp. *citri*	2
Pierce's disease	*Xyella fastidiosa*	2

[55] *Uredo rangelii* is a taxon within the *Puccinia psidii* sensu lato rust complex

References

AS/NZS-4360 (1999) Risk Management. Standards Association of Australia, Strathfield, NSW.

Biosecurity Australia (2009) Draft pest analysis report for '*Candidatus* Liberibacter psyllaurous' in fresh fruit, potato tubers, nursery stock and its vector the tomato-potato psyllid. Biosecurity Australia, Canberra.

FAO (2004) Pest risk analysis for quarantine pests including analysis or environmental risks and living modified organisms. International Standards for Phytosanitary Measures No. 11. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

FAO (2007) Framework for pest risk analysis. International Standards for Phytosanitary Measures No. 2. Secretariat of the International Plant Protection Convention, Food and Agriculture Organization of the United Nations, Rome.

RISK MITIGATION PLAN

Introduction

There are a number of strategies that can be adopted to help protect and minimise the risks of exotic and emergency pests under International Plant Protection Convention (IPPC) standards (**www.ippc.int/IPP/En/default.jsp**) and Commonwealth and State legislation.

Many pre-emptive practices can be adopted to reduce the risk of exotic pest movement for the NGI (Figure 5). Such risk mitigation practices are the responsibility of governments, industry and the community.

A number of key risk mitigation areas are outlined in this guide, along with summaries of the roles and responsibilities of the Australian Government, state/territory governments, and NGI members. This section is to be used as a guide outlining possible activities that may be adopted by industry and growers to mitigate risk. Each grower will need to evaluate the efficacy of each activity for their situation.

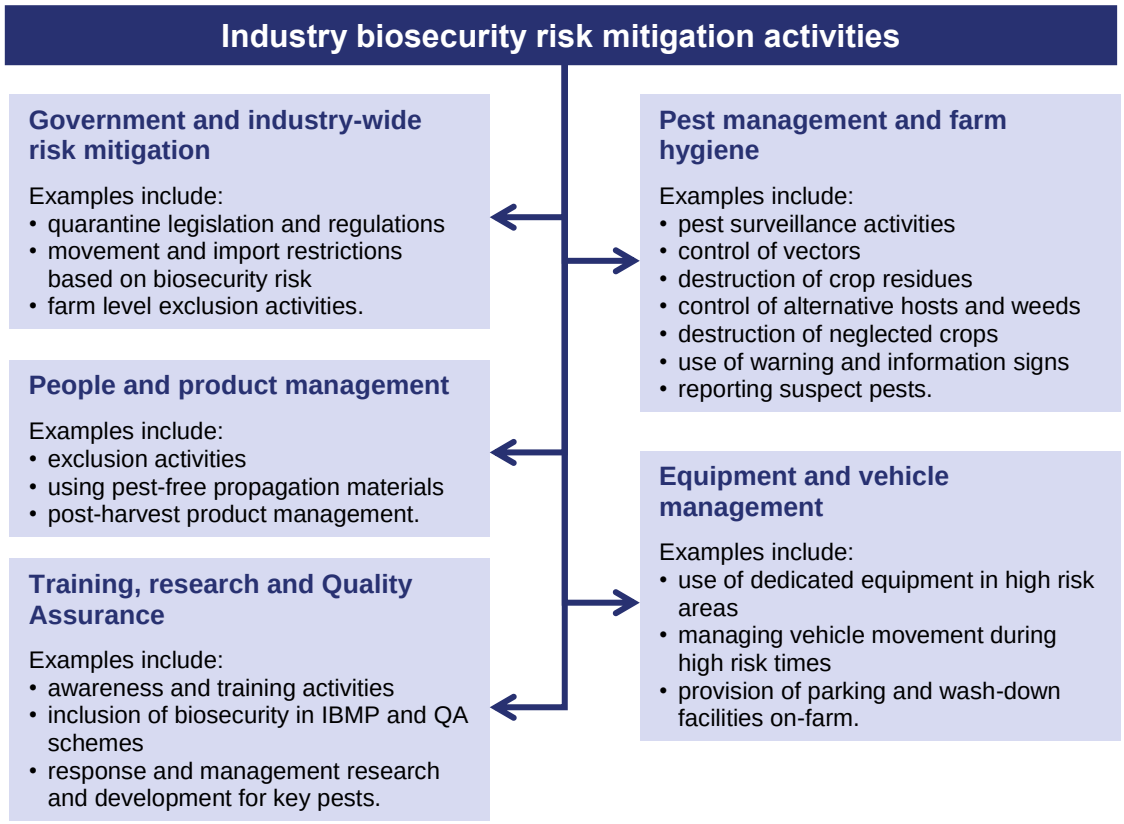

Figure 5. *Examples of biosecurity risk mitigation activities*

Barrier quarantine

Barrier quarantine should be implemented at all levels of the NGI including national, state, regional, and nursery levels.

National level – importation restrictions

Responsibility > Australian Government

The Department of Agriculture, Fisheries and Forestry (DAFF) is the Australian Government department responsible for maintaining and improving international trade and market access opportunities for agriculture, fisheries, forestry, and food industries. DAFF achieves this through:

- establishment of scientifically-based quarantine policies
- provision of effective technical advice and export certification services
- negotiations with key trading partners
- participation in multilateral forums and international sanitary and phytosanitary (SPS) standard-setting organisations
- collaboration with portfolio industries and exporters.

DAFF is responsible for developing biosecurity (SPS) risk management policy and reviewing existing quarantine measures for the importation of live animals and plants, and animal and plant products. In particular, DAFF undertakes import risk analyses to determine which products may enter Australia, and under what quarantine conditions. DAFF also consults with industry and the community, conducting research and developing policy and procedures to protect Australia's animal and plant health status and natural environment. In addition, DAFF assists Australia's export market program by negotiating other countries' import requirements for Australian animals and plants. Further information can be found at **www.daff.gov.au**.

The administrative authority for national quarantine is vested in DAFF under the *Quarantine Act 1908*. Quarantine policies are developed on the basis of an IRA process. This process is outlined in the IRA Handbook 2011 (DAFF, 2011). DAFF maintains barrier quarantine services at all international ports and in the Torres Strait region. The management of quarantine policy, as it relates to the introduction into Australia of fruit, seed, or other plant material, is the responsibility of DAFF.

The Schedule 5 "Permitted Seeds" list from the *Quarantine Proclamation 1998* is maintained on the Import Conditions (ICON) database at **www.aqis.gov.au/icon**. ICON contains the

current Australian import conditions for more than 20,000 foreign plants, animal, mineral and human products and is the first point of access to information about Australian import requirements for a range of commodities. It can be used to determine if a commodity intended for import to Australia requires a quarantine import permit and/or treatment or if there are any other quarantine prerequisites. There are currently a number of cases for nursery and garden plants and plant parts listed on ICON (see Table 11). For export conditions see the Manual of Importing Country Requirements (MICoR) database at **www.daff.gov.au/micor/plants**.

The Australian Government is responsible for the inspection of machinery and equipment being imported into Australia. Any machinery or equipment being imported into Australia must meet quarantine requirements. If there is any uncertainty, contact DAFF on (02) 6272 3933 or 1800 020 504, or visit the website at **www.daff.gov.au/aqis**.

The World Trade Organization (WTO) Sanitary and Phytosanitary Agreement (SPS Agreement) facilitates international trade while providing a framework to protect the human, animal and plant health of WTO members. SPS measures put in place must minimise negative effects on trade while meeting an importing country's appropriate level of protection. For plant products these measures are delivered through the IPPC standard setting organisations and collaboration with portfolio industries and exporters. For more information on the IPPC visit **www.ippc.int**.

Table 11. *Import condition summary for example nursery and garden industry species listed in ICON (as at January 2013)*[56]

Commodity	End use	Import status	Import permit	Additional comments
Aster spp.[57]	Nursery stock	Permitted entry	Required	Condition for import from all countries. All consignments must be accompanied by an official government Phytosanitary certificate. For tissue cultures, Phytosanitary certificates must be endorsed with additional declarations. A Quarantine Entry must be lodged for each consignment.
Aster spp.[57]	Seeds for sowing	Permitted entry	Not required[58]	Condition for import from all countries. All consignments must meet the DAFF Biosecurity standards for seed containments and tolerances. A Phytosanitary certificate is required for full container load consignments.
Aster spp.[59]	Nursery stock, Seeds for sowing	Prohibited entry		Condition for import from all countries.
Impatiens spp.[57]	Nursery stock	Permitted entry	Required	Condition for import from all countries. All consignments must be accompanied by an official government Phytosanitary certificate. For tissue cultures, Phytosanitary certificates must be endorsed with additional declarations. A Quarantine Entry must be lodged for each consignment.
Impatiens spp. [57]	Seeds for sowing	Permitted entry	Not required[58]	Condition for import from all countries. All consignments must meet the DAFF Biosecurity standards for seed containments and tolerances. A Phytosanitary certificate is required for full container load consignments.
Impatiens spp.[60]	Nursery stock, Seeds for sowing	Prohibited entry		Condition for import from all countries.
Muscari spp. [57]	Nursery stock	Permitted entry	Required	Condition for import from all countries. Import permit and Phytosanitary certificate required for non-certified bulbs.

[56] This is a summary only and should not be used as a substitute for consulting the ICON database database (**www.aqis.gov.au/icon32/asp/ex_querycontent.**asp) or AQIS directly to confirm the details of import conditions and any recent changes

[57] Consult ICON for list of permitted species

[58] Import permit only required for genetically modified seed

[59] Particular species are prohibited entry due to the high risk of becoming weeds in Australia. Other species are prohibited entry due to insufficient information available on risk. Consult ICON for lists of species.

[60] *Impatiens cristata*, *Impatiens scabrida*, *Impatiens noli-tangere* and *Impatiens komarovii* are prohibited entry due to insufficient information available on risk

Commodity	End use	Import status	Import permit	Additional comments
Muscari spp.[61]	Seeds for sowing	Permitted entry	Not required[62]	Condition for import from all countries. All consignments must meet the DAFF Biosecurity standards for seed containments and tolerances. A Phytosanitary certificate is required for full container load consignments.
Muscari racemosum	Nursery stock, Seeds for sowing	Prohibited entry		Condition for import from all countries.
Narcissus spp.[61]	Nursery stock	Permitted entry	Required	Condition for import from all countries excluding the Netherlands. Import permit and Phytosanitary certificate required for non-certified bulbs.
Narcissus spp. [61]	Nursery stock	Permitted entry	Required	Condition for import from the Netherlands only. Import permit, documentation and Phytosanitary certificate required for certified bulbs produced under the BKD scheme, Netherlands.
Narcissus spp. [61]	Seeds for sowing	Permitted entry	Not required[62]	Condition for import from all countries. All consignments must meet the DAFF Biosecurity standards for seed containments and tolerances. A Phytosanitary certificate is required for full container load consignments.
Narcissus spp.[63]	Nursery stock, Seeds for sowing	Prohibited entry		Condition for import from all countries.
Morus spp.[64]	Nursery stock	Permitted entry	Required	Condition for import from all countries. All consignments must be accompanied by an official government Phytosanitary certificate. A Quarantine Entry must be lodged for each consignment. Additional conditions apply to tissue cultures.
Morus spp.[64]	Seeds for sowing	Permitted entry	Not required[62]	Condition for import from all countries. All consignments must meet the DAFF Biosecurity standards for seed containments and tolerances. A Phytosanitary certificate is required for full container load consignments.

[61] Consult ICON for list of permitted species
[62] Import permit only required for genetically modified seed
[63] Prohibited species have been assessed as posing a high disease risk and include *Narcissus* 'Gigantic Star', 'Tahiti', 'Peeping Tom', 'Jumbly' and 'February Silver'
[64] Species permitted entry include *Morus acidosa*, *Morus alba*, *Morus alba* var. *constantinopolitana*, *Morus australis*, *Morus multicaulis*, *Morus nigra* and *Morus papyrifera*

State and regional level – movement restrictions

Responsibility > state/territory government

The ability to control movement of materials that can carry and spread pests of the NGI is of high importance. Each state has quarantine legislation in place to control the importation of nursery stock interstate and intrastate, and to manage agreed pests if an incursion occurs (refer to Table 12). Further regulations have been put in place in response to specific pest threats and these are regularly reviewed and updated by state/territory authorities and the Domestic Quarantine and Market Access Working Group (DQMAWG).

Moving plant material between states/territories requires permits for quarantinable pests from the appropriate authority, depending on the plant species and which territory/state the material is being transferred to/from. Moving plant material intrastate (within) may also require a permit from the appropriate authority. Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of nursery stock can be obtained by contacting your local state or territory agriculture agency directly (see Table 12), or through contacts listed on the DQMAWG website **www.domesticquarantine.org.au**. In addition, the Quarantine Domestic Freecall telephone number 1800 084 881 can be used throughout Australia for information regarding the import requirements for the various states.

The movement of farm vehicles and equipment between states is also restricted because of the high risk of inadvertently spreading pests. Each state has quarantine legislation in place governing the movement of machinery, equipment and other potential sources of pest contamination. Information on farm vehicle and equipment movement restrictions can be obtained by contacting your local state/territory department of agriculture (Table 12).

Table 12. *Interstate and interregional movement of plant products – legislation, quarantine manuals and contact numbers*

State	Administering authority	Legislation	Links to quarantine manual[65]	Phone
ACT	Environment ACT **www.environment.act.gov.au**	*Plant Disease Act 2002* *Pest Plants and Animals Act 2005*	See NSW conditions	132 281
NSW	Department of Primary Industries **www.dpi.nsw.gov.au**	*Plant Diseases Act 1924* *Plant Diseases Regulation 2008* *Noxious Weeds Act 1993* *Noxious Weeds Regulation 2008*	**www.dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases**	02 6391 3384
NT	Department of Primary Industry and Fisheries **www.nt.gov.au/d/Primary_Industry**	*Plant Health Act 2008* *Plant Health Regulations 2011*	**www.nt.gov.au/d/Primary_Industry/index.cfm?newscat1=&newscat2=&header=NT%20Quarantine**	08 8999 5511
Qld	Biosecurity Queensland, a part of the Department of Agriculture, Fisheries and Forestry, Queensland **www.daff.qld.gov.au/4790.htm**	*Plant Protection Act 1989* *Plant Protection Regulation 2002*	**www.daff.qld.gov.au/26_114.htm**	132 523[66] 07 3404 6999[67]
SA	Primary Industries and Regions SA **www.pir.sa.gov.au**	*Plant Health Act 2009* *Plant Health Regulations 2010*	**www.pir.sa.gov.au/biosecuritysa/planthealth/legislation/plant_quarantine_standard**	08 8207 7820
Tas	Department of Primary Industries, Parks, Water and Environment **www.dpipwe.tas.gov.au**	*Plant Quarantine Act 1997* *Weed Management Act 1999*	**www.dpipwe.tas.gov.au/inter.nsf/Topics/LBUN-7YQVX9?open**	1300 368 550
Vic	Department of Primary Industries **www.dpi.vic.gov.au**	*Plant Biosecurity Act 2010* *Plant Biosecurity Regulations 2012*	**www.dpi.vic.gov.au/agriculture/horticulture/moving-plants-products/About-Plant-Quarantine-Manual**	136 186
WA	Department of Agriculture and Food **www.agric.wa.gov.au**	*Plant Diseases Act 1914* *Plant Diseases Regulations 1989* *Biosecurity and Agricultural Management Act 2007*[68]	**www.agric.wa.gov.au/PC_92916.html**	08 9368 3333

[65] If the link does not work, the relevant documents can be found by going to the department home page and checking the quarantine section of each website
[66] Within Qld
[67] Interstate
[68] Will replace *Plant Diseases Act 1914* and *Plant Diseases Regulations 1989*. Implementation soon to be underway.

New South Wales

NSW have strict regulations and requirements regarding the entry of plants and plant material (including regulated nursery stock) into the State. These import restrictions have been put in place to prevent the entry of pests including the Red imported fire ant (RIFA), Spiralling whitefly, Green snail, Phylloxera, Potato cyst nematode (PCN), Citrus red mite, Tomato yellow leaf curl virus, Tristeza virus, Panama disease tropical race 4 and Lupin anthracnose. In general, plants and plant material are not permitted to enter NSW unless accompanied by a Plant Health Certificate (PHC) or Plant Health Assurance Certificate (PHAC) certifying compliance with relevant conditions of entry, which may include chemical treatments. A few examples of the specific regulations in place are provided below.

At present there are restrictions on the movement of containerised plants into NSW to prevent the introduction of RIFA. Potted plants originating from Queensland that are within 5km of a RIFA detection, must be accompanied by a PHC or PHAC certifying appropriate treatment. In addition, containerised plants originating from specific areas of Queensland (Brisbane, Caloundra, Gold Coast, Ipswich, Logan, Redcliffe, Beaudesert, Boonah, Caboolture, Esk, Gatton, Kilcoy, Laidley, Maroochy, Noosa, Pine Rivers and Redland) must be accompanied by a PHC or PHAC certifying that the material has not been within 5km of a RIFA detection, or that appropriate treatment has been undertaken.

NSW has restrictions on the entry of plants (potted plants, bare rootstock and cuttings) which have originated from, or moved through, the northern parts of Queensland, the Northern Territory, or any part of another Sate or Territory where an outbreak of the Spiralling whitefly has been confirmed. Plants must be accompanied by a PHC or PHAC certifying appropriate inspection or treatment, or that the plant is from a property or area that has been certified as free from the pest.

There are current restrictions in place in NSW for the movement of Green snail host plant material (including leafy vegetables, cuttings, cut-flower and foliage, potted plants, turf and bare rooted plants) which originates from, or has moved through a State or Territory where an infestation of Green snail is known to exist (Perth Region and Northern Victoria). Host plant material is prohibited entry unless originating from an area for which an Area Freedom Certificate is currently in force, or the consignment is accompanied by a PHC or PHAC.

NSW has restrictions on the importation of regulated nursery stock. Importation of nursery stock (bulbs, potted plants, trees and bare rooted stock) sourced or packed within a 20km radius of a known PCN detection is prohibited unless the property is accredited with DPI Victoria, or is in a PCN non-linked area. In addition consignments must be accompanied by a PHAC. Advanced, containerised field grown trees grown or sourced within 20km of a known PCN detection must not be moved without a permit from NSW DPI. As this pest may be

transported in soil, further restrictions apply to the movement of machinery, equipment and packaging.

Further information on pre-importation inspection, certification and treatment requirements may be obtained from **www.dpi.nsw.gov.au/aboutus/about/legislation-acts/plant-diseases** or by phoning NSW DPI Regulatory Services (02) 6391 3384.

Northern Territory

Administrative authority for regional quarantine in the Northern Territory (NT) is vested in the Department of Primary Industry and Fisheries (DPIF) under the *Plant Health Act 2008* and *Plant Health Regulations 2011*. The Act enables notifiable pests to be gazetted, quarantine areas to be declared and inspectors appointed to carry out wide ranging control and/or eradication measures. Plant import requirements for particular pests, plants or plant related materials are identified in the Regulations.

In general, plants (including bulbs and rhizomes) must be bare-rooted and otherwise free of soil unless accompanied by a PHC or PHAC certifying appropriate treatments. In addition, plants must not have been grown within an area infested with Grape phylloxera or PCN, or within 50m of a grapevine, 20km of the boundary of an area infested with Phytophthora or 25km of the boundary of an area infested with Green snail, Conical snail, Pointed snail, White Italian snail, Vineyard white snail or Common white snail. Plants (including nursery stock) must also be certified as inspected and free from the RIFA, Yellow crazy ant, Argentine ant and Electric ant. They must also have undergone approved treatment for scale insects and whitefly within 72h before consignment.

Host plants of Western flower thrips originating from any part of the country, State or Territory that was infested with Western flower thrips at any time within two years prior to transportation must be accompanied by a PHC or PHAC certifying they are free from the pest or have undergone approved treatment. Host plants of Melon thrips must also be accompanied by a PHC or PHAC certifying inspection and/or approved treatment.

Myrtaceae plants that have been grown or kept in a State or Territory in which Myrtle rust is known to occur are prohibited entry unless the host plant is imported from a nursery and is accompanied by a PHC or PHAC certifying the nursery was free from Myrtle rust symptoms. Myrtaceae plants that include tissue cultured material are prohibited entry unless accompanied by a Permit for Introduction of tissue cultured material.

Further information on NT import requirements and treatments can be obtained from the DPIF website (**www.nt.gov.au/d**) or by contacting NT Quarantine on (08) 8999 2118 or email **quarantine@nt.gov.au**.

Queensland

Information on specific pre-importation inspection, treatments and/or certification requirements for movement of plant material into Queensland, as well as maps of pest quarantine areas, may be obtained from the Biosecurity Queensland part of the DAFF Qld website (**www.daff.qld.gov.au/26_114.htm**). Further details can be obtained from the DAFF Qld Customer Service Centre (13 25 23 within Queensland, or phone (07) 3404 6999 or fax (07) 3404 6900 interstate).

At present, there are restrictions on the import of plants from the family Myrtaceae into Queensland to prevent the spread of Myrtle rust. Plants grown in or dispatched from another State in which Myrtle rust has been detected are prohibited entry unless all plants in the consignment have been inspected and found free from Myrtle rust symptoms.

Where certification is required to move plants and plant material in areas restricted under quarantine measures, a business can become accredited under the Interstate Certification Assurance (ICA) scheme, to certify that plants consigned to intrastate or interstate markets meet specified quarantine requirements. Alternatively, plants and their products can be certified by a Biosecurity Officer. Contact the DAFF Qld Customer Service Centre for information on the closest Biosecurity Officer in your area.

South Australia

Information on pre-importation inspection, certification and treatments and/or certification requirements for movement of fruit or plant material in South Australia (SA) may be obtained from Biosecurity SA - Plant Health by phone (08) 8207 7820 or fax (08) 8207 7844. Further information can be found at **www.pir.sa.gov.au/biosecuritysa/planthealth**.

Primary Industries and Regions South Australia (PIRSA) have strict regulations and requirements regarding the entry of plants and plant material into the State of SA. Import restrictions have been put in place to prevent the entry into SA of pests and diseases including RIFA, Myrtle rust, Phylloxera, Green snail, PCN and Fire blight. Plants and plant material are not permitted to enter SA unless accompanied by a PHC or PHAC certifying that the produce is free of disease or has been appropriately treated. If accompanied by a PHAC, this must have been issued by a business accredited under the National ICA scheme. The original certificate must accompany plants during transport. A transport manifest, detailing all plant consignments, must be sent to PIRSA (fax 08 8124 1467 or email to **Pirsa.PlantHealthManifest@sa.gov.au**) prior to plants arriving in SA. For further information on import conditions consult the Plant Quarantine Standard (**www.pir.sa.gov.au/biosecuritysa/planthealth/legislation**).

Tasmania

General and specific import conditions apply to the importation of plants and plant products into Tasmania to prevent the introduction of pests and diseases into the State. For example, import of nursery stock into Tasmania must meet State import requirements and be accompanied by a Notice of Intention to Import. Currently, all species in the family Myrtaceae are prohibited entry to Tasmania, unless prospective importers have sought and been granted written approval to import by means of a Section 67 exemption under the Plant Quarantine Act 1997 via the Department of Primary Industries, Parks, Water and Environment (DPIPWE).

To facilitate market access for nursery stock entering Tasmania other than Myrtaceae, Import Requirement 38 (IR38) was introduced. It provides four different options for importation of nursery stock including chemical treatment (IR39A), industry best practice (IR38B), approved quarantine premises (IR38C) and special circumstances (IR38D). IR38B was developed with cooperation from NGIT and NGIA as an alternative to the chemical treatment option, and is based on nursery industry best practice. The mainland supplier is required to be accredited with the Nursery Industry Accreditation Scheme Australia (NIASA) as well as meeting some other criteria and the Tasmanian importer must also meet certain criteria. For further information on import conditions consult the DPIPWE Biosecurity website (**www.dpipwe.tas.gov.au/biosecurity**).

Victoria

Plants, plant products and other host materials are prohibited entry into Victoria unless accompanied by a PHC or PHAC certifying compliance with relevant conditions of entry, which may include chemical treatments. Materials which are hosts of a specified pest or disease may enter Victoria without certification in relation to that pest or disease if sourced from an area covered by an Area Freedom Certificate. Conditions of entry are described in the Plant Quarantine Manual (see link in Table 12). Some items may need to be presented to a DPI inspector for checking of details such as correct certification, labelling or treatment. In general, fruit must be presented for inspection. Businesses may be accredited by the DPI under a compliance agreement to perform these checks on behalf of DPI.

Further information on pre-importation inspection, certification and treatment requirements may be obtained from the DPI Customer Service Centre by phone 136 186.

Western Australia

The lead agency for agricultural biosecurity in Western Australia (WA) is the Department of Agriculture and Food (DAFWA). Plants are not permitted entry into the State unless they are native to WA, or listed in Schedule 5 of *Plant Diseases Regulations 1989*. For species allowed entry, specific certification or treatments may be required. For example, host plants (and plant parts) of Melon thrips must be certified if originating from within 100km of an outbreak of

Melon thrips. To prevent the spread into WA of the disease Myrtle rust, temporary import restrictions have been placed on plants or plant parts including cut flowers, foliage, seed, fruit, tissue cultures and dry plant material, of the family Myrtaceae. In addition, there are specific intrastate controls on the movement of plants and plant material to reduce the risk of pest or disease spread. For further information on plant or plant material movement requirements into WA, or into the Ord River Irrigation Area, contact Quarantine WA (08) 9334 1800 or fax (08) 9334 1880.

Production nursery level – exclusion activities

Responsibility > state/territory government, industry/growers and production nursery operators

A significant risk of spreading pests onto production nurseries arises when propagation material, people, machinery and equipment move from property to property and from region to region. This is important for the NGI due to the large volume and variety of material being moved by nursery product suppliers, distributors and purchasers in Australia. It is the responsibility of the industry and the owner/manager of each property to ensure these risks are minimised.

It is in the interests of industry to encourage and monitor the management of risk at the production nursery level, as this will reduce the probability of an incursion and increase the probability of early detection. This should in turn reduce the likelihood of a costly incident response, thereby reducing costs to industry, government and the community.

One major way this can be achieved is through management of industry biosecurity at the production nursery level using exclusion practices. Further detail on potential strategies is included in the Production nursery biosecurity section (page 73).

Garden centres and retailers – ‘hitch-hikers’

Responsibility > state/territory government, industry/growers and nursery operators

Garden centres and retail outlets, including chain and hardware stores, can be the primary distributors of ornamental and landscape nursery stock in a given region. It is vital to ensure that pests are not introduced into new areas as ‘hitch-hikers’ on nursery stock. Produce transporters and purchasers/agents/buyers for retail outlets (e.g. Garden centres, Woolworths, Bunnings, etc) must obtain advice from state quarantine authorities before moving nursery stock between regions or interstate. Advice in all states is available free of charge from the Domestic Quarantine website (**www.dqmawg.org.au**).

Industry Best Management Practice

Good nursery production hygiene practices help to prevent pest spread. The Nursery Production Farm Management System (FMS) encourages good hygiene, pest monitoring and traceability in production nurseries. The FMS includes the NGIA NIASA, EcoHort and BioSecure *HACCP* Best Management Practices. These provide guidelines for owners of production nurseries, greenlife markets and growing media suppliers for maintaining high health standards. Examples of relevant production nursery hygiene practices include training of staff to recognise pest and disease symptoms, controlling pests in nursery crops, and sterilisation of growing media and equipment. Information on NIASA, EcoHort and BioSecure *HACCP* can be obtained from the NGIA website (**www.ngia.com.au**) or the NGI office in your state (see Table 18).

Traceability

Biosecurity traceability allows for the trace-back of plant material and production nursery inputs on a property to its source, the trace-forward of plant material that has left the property, and the provision of records of surveillance and pest management practices undertaken on the property.

Nursery stock should be labelled in a manner that allows the source to be identified for trace-back purposes. A register should be maintained of all production inputs including the source (with contact details), specific planting or storage locations, numbers of plants (or other products) and the date of use. An example register is provided in the Biosecurity Manual for the Nursery Production Industry (**www.planthealthaustralia.com.au**). Records should also be kept of all plant material leaving a property for trace-forward purposes. Where pest or disease symptoms are found it is important to quarantine nursery stock in a designated quarantine area and identify the causal agent. New or unfamiliar pests should be reported for identification (see Reporting Suspect Pests section on page 74).

Surveillance

Surveys enhance prospects for early detection, minimise costs of eradication and are necessary to meet the treaty obligations of the WTO Sanitary and Phytosanitary Agreement (SPS) with respect to the area freedom status of Australia's states, territories and regions.

The SPS agreement gives WTO members the right to impose SPS measures to protect human, animal and plant life health provided such measures do not serve as technical barriers to trade. In other words, for countries (such as Australia) that have signed the SPS Agreement, imports of food, including fresh fruit and vegetables, can only be restricted on proper, science-based quarantine grounds. Where quarantine conditions are imposed, these will be the least trade restrictive measures available that meet Australia's appropriate level of quarantine protection. The agreement also stipulates that claims of area freedom must be supported by appropriate information, including evidence from surveillance and monitoring activities. This is termed "evidence of absence" data and is used to provide support that we have actively looked for pests and not found them.

There are currently no international standards for structured pest surveys. Their planning and implementation depends on the risk involved, the resources available, and the requirements of trading partners (particularly when Australia wishes to access overseas markets). The intensity and timing of surveys also depend on the spread characteristics of the pest and the costs of eradication.

Early detection of an exotic incursion can significantly increase the likelihood of a successful eradication campaign, and reduce the associated costs. Effective surveillance plays a critical role in working toward this goal. Surveillance can be either targeted toward specific pests, or general in nature. General non-targeted surveillance is based on recognising normal versus suspect plant material. Targeted surveillance is important for establishing whether particular pests are present in each state or region, and if so, where these occur.

Industry personnel can provide very effective general surveillance as part of their normal management procedures (i.e. 'passive surveillance'), provided individuals are aware of what to look for and of reporting procedures. Consultants and crop scouts can provide valuable information as they are regularly in the field, and hence can observe any unusual pest activity or symptoms on plants.

National surveillance programs

Responsibility > Australian Government, industry (national associations)

DAFF maintains barrier quarantine services at all international ports and in the Torres Strait region. DAFF also surveys the northern coast of Australia, offshore islands and neighbouring countries for exotic pests that may have reached the country through other channels (e.g. illegal vessel landings in remote areas, bird migrations, wind currents) as part of the Northern Australia Quarantine Strategy (NAQS).

State surveillance programs

Responsibility > state/territory governments, industry/growers and nursery operators

State level surveillance depends on the participation of all stakeholder groups, particularly state/territory agriculture departments, industry representative groups, agri-business and growers.

The state agriculture department can provide:

- planning and auditing surveillance systems
- coordination of surveillance activities between industry and interstate groups
- diagnostic services
- field diagnosticians for special field surveillance
- surveillance on non-commercial sites
- liaison services with industry members
- communication, training and extension strategies with industry
- biosecurity training
- reporting services to all interested parties (DAFF, national bodies, trading partners and industry).

Various pest surveillance programs are managed by DAFF and the state/territory agriculture departments. Many state departments run general surveillance programs whereby suspect samples can be forwarded and diagnosed for the presence of exotic pests free of charge. Official surveillance programs that target pests of the NGI (exotic or those under official control in a region or state) are shown in Table 13.

Table 13. *Official surveillance programs that target pests of the nursery and garden industry*[69]

Surveillance program	Pests targeted	State/region	Deliverer
NAQS Pest and Disease Survey	Mirid bugs, Black twig borer, Poinsettia thrips, planthoppers, Asian citrus psyllid, Giant African snail, Citrus mealybug, Palm lethal yellowing phytoplasma, Pea leafminer, American leafminer, Yellow crazy ant, Bayberry whitefly, Oleander pit scale, Grapevine rust, Eucalyptus/Guava rust, Bacterial wilt, Citrus canker and Huanglongbing	Australia's northern coastline from Cairns to Broome (Qld, NT and WA), including the Torres Strait – natural environments, agricultural and urban regions, ports of entry	NAQS
National Asian gypsy moth trapping program[70]	Asian gypsy moth (*Lymantria dispar*), *Lymantria* spp.	NSW, Qld, SA, Tas, Vic, and WA – major urban regions and ports of entry	DAFWA, DAFF Qld, DPIPWE Tas, DPI Vic, NSW DPI, PIRSA, The University of Melbourne
Red imported fire ant surveillance	Red imported fire ant (*Solenopsis invicta*)	NT North West – major urban regions; Qld – Agricultural and major urban regions; Tas – major urban regions	NT and all state governments, except WA
Potato spindle tuber viroid response surveillance	Potato spindle tuber viroid (PSTVd)	Southern Qld	DAFF Qld
Urban surveillance program	A range of pests and diseases are surveyed on ornamentals and fruit and vegetables	Agricultural and major urban regions of Qld	DAFF Qld
Myrtle rust surveillance	Myrtle rust (*Puccinia psidii* sensu lato)	Agricultural and major urban regions of WA	DAFWA, DECWA
Potato cyst nematode surveillance	Potato cyst nematode (*Globodera rostochiensis*)	Agricultural regions of WA	DAFWA
Potato spindle tuber viroid (d)	Potato spindle tuber viroid d (PSTVd) (*Potato spindle tuber viroid d* (*Pospiviroid*))	Carnarvon and urban production nurseries	DAFWA
WA Plant pest hotline	Red imported fire ant (*Solenopsis invicta*)	Major urban and forestry regions of WA	DAFWA

[69] Information presented has been taken from the National Plant Health Status Report 2011 and confirmed or updated by the Subcommittee on National Plant Health Surveillance (sub-committee of the Plant Health Committee)
[70] Funded by DAFF

Surveillance program	Pests targeted	State/region	Deliverer
HortGuard passive surveillance	Covers all pests and diseases exotic to WA such as Bacterial wilt (*Ralstonia solanacearum*), Pierce's disease (*Xylella fastidiosa*), Potato cyst nematode (*Globodera pallida, G. rostochiensis),* Potato spindle tuber viroid (PSTVd) (*Potato spindle tuber viroid* (*Pospiviroid*))	Major urban and horticultural regions of WA	DAFWA
Giant African snail surveillance	Giant African snail (*Achatina fulica*)	Ports of entry	DPIF NT
Thrips surveillance	Melon thrips *(Thrips palmi)*, Western flower thrips (*Frankliniella occidentalis*)	Darwin, Palmerston, Darwin rural area, Adelaide River	DPIF NT
Nursery industry surveillance	Myrtle rust (*Puccinia psidii* sensu lato), Purple scale (*Lepidosaphes beckii*), San Jose scale (*Quadraspidiotus peniciosus*)	Agricultural and urban areas of NT	DPIF NT
Whitefly surveillance	Silverleaf whitefly (*Bemisia tabaci*), Spiralling whitefly (*Aleurodicus dispersus*)	Agricultural regions of NT	DPIF NT
Myrtle rust survey	Myrtle rust (*Puccinia psidii* sensu lato)	Statewide	DPIPWE Tas
Grapevine phylloxera	Grapevine phylloxera (*Daktulosphaira vitifoliae*)	Agricultural regions of Vic	DPI Vic
Green snail area freedom surveillance	Green snail (*Cantareus apertus* [71])	A major agricultural area of Vic	DPI Vic
Exotic plant pest response	Myrtle rust (*Puccinia psidii* sensu lato)	Major urban regions of Vic	DPI Vic
Potato cyst nematode soil sampling	Potato cyst nematode (*Globodera pallida, G. rostochiensis)*	Agricultural regions of Vic	DPI Vic
Tomato yellow leaf curl virus area freedom surveillance	Tomato yellow leaf curl virus (TYLCV) (*Tomato yellow leaf curl virus* (*Begomovirus*))	Agricultural regions of Vic	DPI Vic
Urban hazard site surveillance	African land snail , Apple and pear rust, *Coleosporium* spp., Daylily rust, Fire blight , Glassy-winged sharpshooter , Grape leaf rust, Asian gypsy moth, Olive knot	Major urban regions and ports	NSW DPI
Fire blight	*Erwinia amylovora*	Adelaide Hills	PIRSA

[71] Synonym: *Helix aperta*

Surveillance program	Pests targeted	State/region	Deliverer
Grapevine phylloxera	Grapevine phylloxera (*Daktulosphaira vitifoliae*)	Viticultural regions of SA	Phylloxera and Grape Industry Board SA, PIRSA
Citrus greening	Huanglongbing (*Candidatus* Liberibacter asiaticus, *Candidatus* Liberibacter africanus)	Adelaide and major urban regions of SA	PIRSA
Myrtle rust	Myrtle rust (*Puccinia psidii* sensu lato)	Adelaide and major urban regions of SA	PIRSA
Potato cyst nematode	Potato cyst nematode (*Globodera pallida, G. rostochiensis)*	Agricultural regions of SA	PIRSA
Silver leaf whitefly	Silverleaf whitefly (*Bemisia tabaci*)	Glasshouses/hothouses, Northern Adelaide Plains	PIRSA
Spiralling whitefly	Spiralling whitefly (*Aleurodicus dispersus*)	Adelaide and major urban regions of SA	PIRSA
Tomato yellow leaf curl virus	Tomato yellow leaf curl virus (TYLCV) (*Tomato yellow leaf curl virus*) (*Begomovirus*)	Glasshouses/hothouses, Northern Adelaide Plains	PIRSA

Production nursery surveillance activities

Responsibility > industry/growers and nursery operators

Production nursery (on-farm) level surveillance involves the participation and interaction of growers, agribusiness and industry representative groups. Examples of the surveillance activities that can be carried out by each of these groups are outlined in Figure 6. Conducting regular surveys of production nurseries provides the best chance of spotting new pests early and implementing eradication or management responses.

Production nurseries operating to NIASA guidelines are required to monitor pest activity in the production nursery, effectively control pests, and keep a pest management record diary.

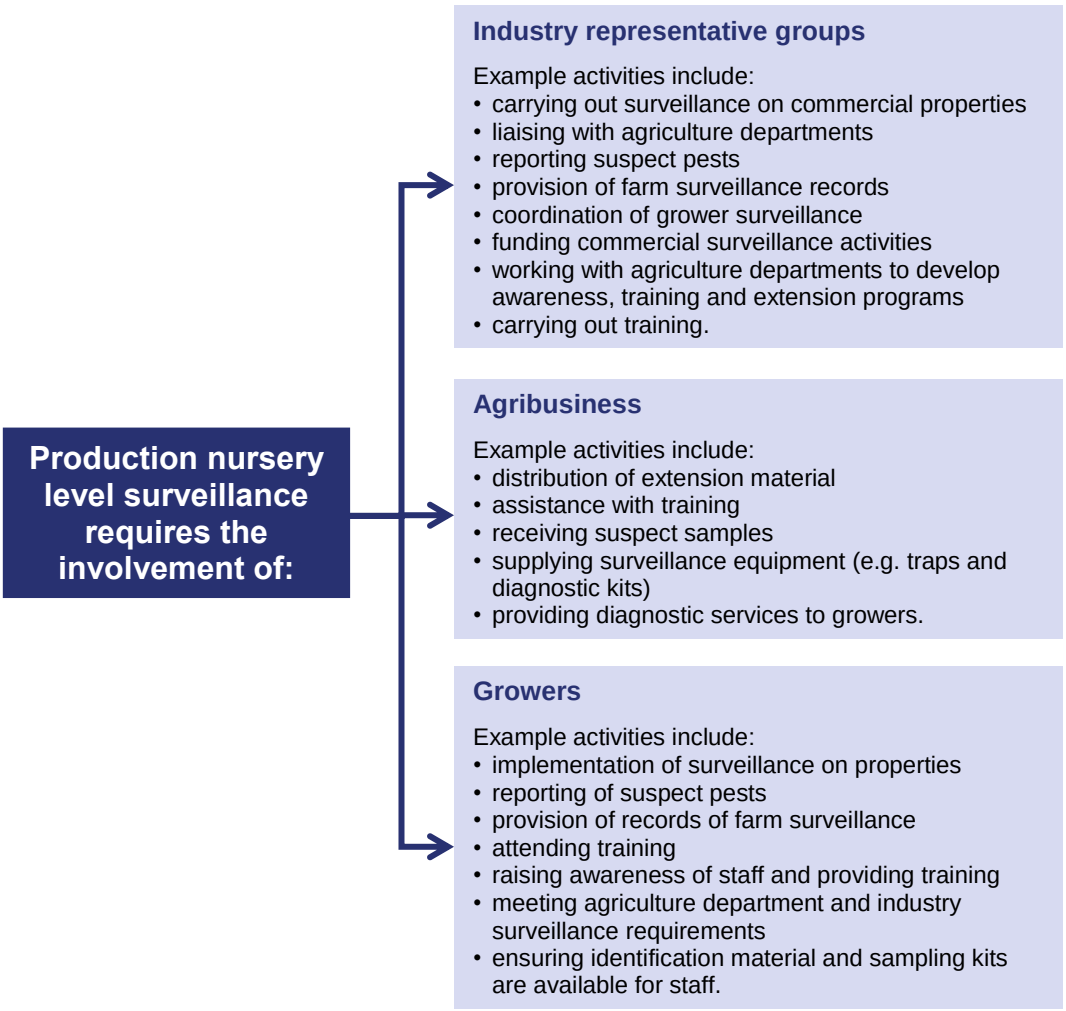

Figure 6. *Examples of production nursery level surveillance activities*

Training

A key component of EPP preparedness is ensuring suitable and effective training for people involved in responding to EPP incursions. Effective training is the responsibility of both government and industry.

PHA's national training program for EPP preparedness

The PHA national training program is a program for industry and government personnel who have roles and responsibilities as members of the various committees under PLANTPLAN, the national emergency response plan for the plant industries. This includes training for Industry Liaison Officers and Industry Liaison Coordinators.

Training programs will help ensure personnel involved in responding to EPPs are proficient and have the skills required to effectively perform their duties.

Additionally, training material on biosecurity awareness has been developed that is available to all PHA members to assist raising awareness of biosecurity issues (Table 14). This is targeted at industry leaders, agricultural consultants/extension officers, growers and the general community.

Table 14. *Training materials from PHA's National Training Program for EPP preparedness*[72]

Training/briefing material available
Consultative Committee on Emergency Plant Pests
Domestic Quarantine and Market Access Working Group
National Management Group
Industry Liaison Officer/Coordinator
PLANTPLAN incursion response roles - various
Biosecurity awareness (industry leaders, consultants/extension officers, growers, community)
EPPRD awareness training
PHA Biosecurity On-line Training (BOLT)

[72] Refer to the PHA website for the most up-to-date information, or contact PHA for further details

Awareness

Early reporting enhances the chance of effective control and eradication. Awareness activities (such as the poster shown in Figure 7) raise the profile of biosecurity and exotic pest threats to the NGI, which increases the chance of early detection and reporting of suspect pests. Responsibility for awareness material lies with industry and government, with assistance from PHA as appropriate. Any unusual plant pest should be reported immediately to the relevant state/territory agriculture agency.

Figure 7. *Poster from Plant Health Australia's Plant Health Awareness campaign*

High priority plant pest threat-related documents

Pests listed in Table 5 have been identified as high priority threats to the NGI by members of the IBG. They have been assessed as having high entry, establishment and spread potentials and/or a high economic impact. This list should provide the basis for the development of awareness material for the industry.

Further information on high priority pests

In addition to the documents listed in Table 20, the websites listed below (Table 15) contain information on pests across most plant industries, including the NGI.

Table 15. *Sources of information on high priority pest threats for the nursery and garden industry*

Source	Website
Department of Agriculture, Forestry and Fisheries (DAFF)	**www.daff.gov.au**
Pest and Disease Image Library (PaDIL)	**www.padil.gov.au**
DAFF Queensland exotic plant pests and disease list	**www.daff.qld.gov.au/26_6460.htm**
University of California Statewide Integrated Pest Management (IPM) Program	**www.ipm.ucdavis.edu/EXOTIC/exoticpestsmenu.html**

Further information/relevant web sites

A range of government and grower organisation details and websites are provided below (Table 16) for persons seeking further information on NGI biosecurity.

Table 16. *Relevant sources of further biosecurity information for the nursery and garden industry*

Agency	Website/email	Phone	Address
National			
Nursery & Garden Industry Australia	**www.ngia.com.au** **info@ngia.com.au**	(02) 8861 5100	Unit 58, Quantum Corporate Park 5 Gladstone Road, Castle Hill NSW 2154
Australian Government Department of Agriculture, Fisheries and Forestry	**www.daff.gov.au** **www.daff.gov.au/aqis**	(02) 6272 3933 1800 020 504	GPO Box 858 Canberra, ACT 2601
Plant Health Australia	**www.planthealthaustralia.com.au** **biosecurity@phau.com.au**	(02) 6215 7700	Level 1, 1 Phipps Cl Deakin, ACT 2600
New South Wales			
Department of Primary Industries	**www.dpi.nsw.gov.au**	1800 808 095	Locked Bag 21 Orange, NSW 2800
Queensland			
Biosecurity Queensland, a part of the Department of Agriculture, Fisheries and Forestry, Queensland	**www.daff.qld.gov.au** **callweb@daff.qld.gov.au**	13 25 23[73] 07 3404 6999[74]	80 Ann Street Brisbane, QLD 4000

[73] Within Qld
[74] Interstate

Agency	Website/email	Phone	Address
Northern Territory			
Department of Primary Industry and Fisheries	**www.nt.gov.au/d/Primary_Industry** **info.DPIF@nt.gov.au**	(08) 8999 5511	Berrimah Farm, Makagon Road Berrimah, NT 0828
South Australia			
Primary Industries and Regions SA	**www.pir.sa.gov.au** **www.pir.sa.gov.au/pirsa/content/customer_enquiry_form**	(08) 8226 0222	GPO Box 1671 Adelaide, SA 5001
Biosecurity SA-Plant Health	**www.pir.sa.gov.au/biosecuritysa/planthealth**	(08) 8207 7820	33 Flemington Street Glenside, SA 5065
South Australian Research and Development Institute	**www.sardi.sa.gov.au** **sardi@sa.gov.au**	(08) 8303 9400	2b Hartley Grove Urrbrae, SA 5064
Tasmania			
Department of Primary Industries, Parks, Water and Environment	**www.dpipwe.tas.gov.au** **BPI.Enquiries@dpipwe.tas.gov.au**	1300 368 550	GPO Box 44, Hobart, TAS 7001
Victoria			
Department of Primary Industries	**www.dpi.vic.gov.au**	136 186	Plant Biosecurity and Product Integrity Private bag 15 Ferntree Gully Delivery Centre, Vic 3156
Western Australia			
Department of Agriculture and Food	**www.agric.wa.gov.au** **enquiries@agric.wa.gov.au**	(08) 9368 3333	DAFWA 3 Baron-Hay Court South Perth, WA 6151

Production nursery biosecurity

Plant pests can have a major impact on production if not managed effectively. This includes pests already present in Australia and a number of serious pests of the NGI that Australia does not have.

Production nursery biosecurity measures can be used to minimise the spread of such pests before their presence is known or after they are identified, and therefore can greatly increase the likelihood that they could be eradicated. PHA, in conjunction with NGIA, has developed a Biosecurity Manual for the Nursery Production Industry (**www.planthealthaustralia.com.au**) which outlines production nursery biosecurity and hygiene measures that help reduce the impact of pests on the industry. This manual covers biosecurity aspects such as:

- recognising the HPPs of the production nursery industry
- managing the movements of vehicles and machinery
- managing the movement of people
- the use of warning and information signs
- visiting overseas farms/orchards/nurseries – what to watch out for when you return
- quality and hygiene Best Management Practices
- the use of high health status production nursery inputs such as growing media, fertiliser and propagation material
- management of water quality and production nursery waste
- washdown facilities and designated parking areas.

NGIA has developed an industry specific on-farm biosecurity program (BioSecure *HACCP*) as a component of the Nursery Production Farm Management System. BioSecure *HACCP* is a holistic biosecurity program developed under the principles of HACCP (Hazard Analysis Critical Control Point) that provides production nurseries with science based risk mitigation strategies that reduce the threat and impact of plant pests. BioSecure *HACCP* addresses:

- internal quarantine disciplines and risk reduction
- nursery production biosecurity hazards
- biosecurity critical control points
- nursery production hygiene processes
- plant protection systems and procedures
- property surveillance
- crop monitoring
- consignment inspections
- recording.

BioSecure *HACCP* assists production nurseries in:

- protecting market access
- recognising investment in biosecurity
- on-site assistance in HACCP identification
- pest/disease management reducing losses
- providing customer confidence in product
- reduced costs via government co-regulation
- positioning a business for export.

Reporting suspect pests

Any unusual plant pest should be reported immediately to the relevant state/territory agriculture agency through the Exotic Plant Pest Hotline (1800 084 881). Early reporting enhances the chance of effective control and eradication.

Reporting an exotic plant pest carries serious implications and should be done only via the Exotic Plant Pest Hotline. Careless use of information, particularly if a pest has not been confirmed, can result in extreme stress for individuals and communities, and possibly damaging and unwarranted trade restrictions.

If you suspect a new pest, call the Exotic Plant Pest Hotline on 1800 084 881

Calls to the Exotic Plant Pest Hotline will be forwarded to an experienced person in the department of agriculture from the state of origin of the call, who will ask some questions about what you have seen and may arrange to collect a sample. Every report will be taken seriously, checked out and treated confidentially.

In some states and territories, the Exotic Plant Pest Hotline only operates during business hours. Where this is the case, and calls are made out of hours, callers should leave a message including contact details and staff from the department of agriculture will return the call the following business day.

Some NGI pests are notifiable under each state or territory's quarantine legislation. The complete list of notifiable pests can be downloaded from the PHA website[75]; however, each state's list of notifiable pests are subject to change over time so contacting your local

[75] Available from **www.planthealthaustralia.com.au/biosecurity/notifiable-pests**

state/territory agricultural department (details in Table 12) will ensure information is up to date. Landowners and consultants have a legal obligation to notify the relevant state/territory agriculture department of the presence of those pests within a defined timeframe (Table 17).

Table 17. *Timeframe for reporting of notifiable pests as defined in state/territory legislation*

State/territory	Notifiable pest must be reported within
NSW	24 hours
NT	24 hours
Qld	24 hours
SA	Immediately
Tas	As soon as possible
Vic	Without delay
WA	24 hours

Suspect material should not generally be moved or collected without seeking advice from the relevant state/territory department, as incorrect handling of samples could spread the pest or render the samples unsuitable for diagnostic purposes. State/territory agriculture department officers will usually be responsible for sampling and identification of pests.

Reference

DAFF (2011) Import Risk Analysis Handbook 2011. Australian Government Department of Agriculture, Fisheries and Forestry, Canberra.

CONTINGENCY PLANS AND RESPONSE MANAGEMENT

Introduction

Gathering information, developing procedures, and defining roles and responsibilities during an emergency can be extremely difficult. To address this area, PHA coordinated the development of PLANTPLAN, a national set of incursion response guidelines for the plant sector, detailing procedures required and the roles and responsibilities of all parties involved in an incursion response.

Following PLANTPLAN, a set of threat-specific contingency plans will be developed to cover the key exotic pests to the NGI. These pests are detailed in the high priority plant pest threat list (Table 5) and have been identified through a process of qualitative risk assessment. Information will be provided on the host range, symptoms, biology and epidemiology of each pest, along with guidelines for general and targeted surveillance programs, diagnosis, and control. These documents are designed to assist with the development of response plans and will be used in conjunction with the emergency response guidelines in PLANTPLAN.

This section includes key contact details and any communication procedures that should be used in the event of an incursion in the NGI. Additionally, a listing of pest-specific emergency response and information documents are provided. Over time, as more of these documents are produced for pests of the NGI they will be included in this document and made available through the PHA website.

PLANTPLAN

PLANTPLAN provides a description of the general procedures, management structure and information flow system for the handling of a plant pest emergency at national, state/territory and district levels. This includes the operations of the control centres, principles for the chain of responsibility, functions of sections and role descriptions. PLANTPLAN is a general manual for use by all jurisdictions for all plant pest emergencies.

PLANTPLAN is regularly reviewed and updated to ensure it provides the best possible guidance to plant industries and governments in responding to serious plant pests. The most recent version of PLANTPLAN can be downloaded from the PHA website (**www.planthealthaustralia.com.au/plantplan**).

Following the detection of a suspect exotic plant pest, the relevant state agency should be immediately notified directly or through the Exotic Plant Pest Hotline. Within 24 hours of the initial identification, the agency, through the State Plant Health Manager, will inform the Australian Chief Plant Protection Office (ACPPO) which will notify other relevant Australian Government Departments and relevant state agencies and industry representatives (process outlined in Figure 8). Following the detection or reporting of the pest, the relevant state/territory agriculture agency may collect samples of a suspect pest and seek a positive identification. If the pest is suspected to be an exotic pest (not yet present in Australia), the general process is as outlined in Figure 9.

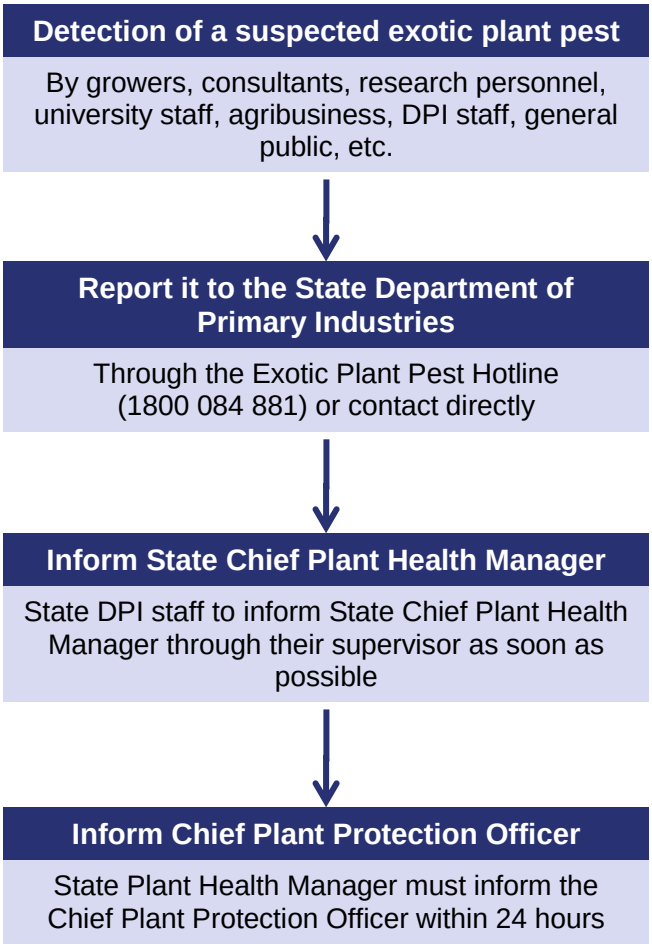

Figure 8. *Suspect exotic plant pest detection reporting flowchart*

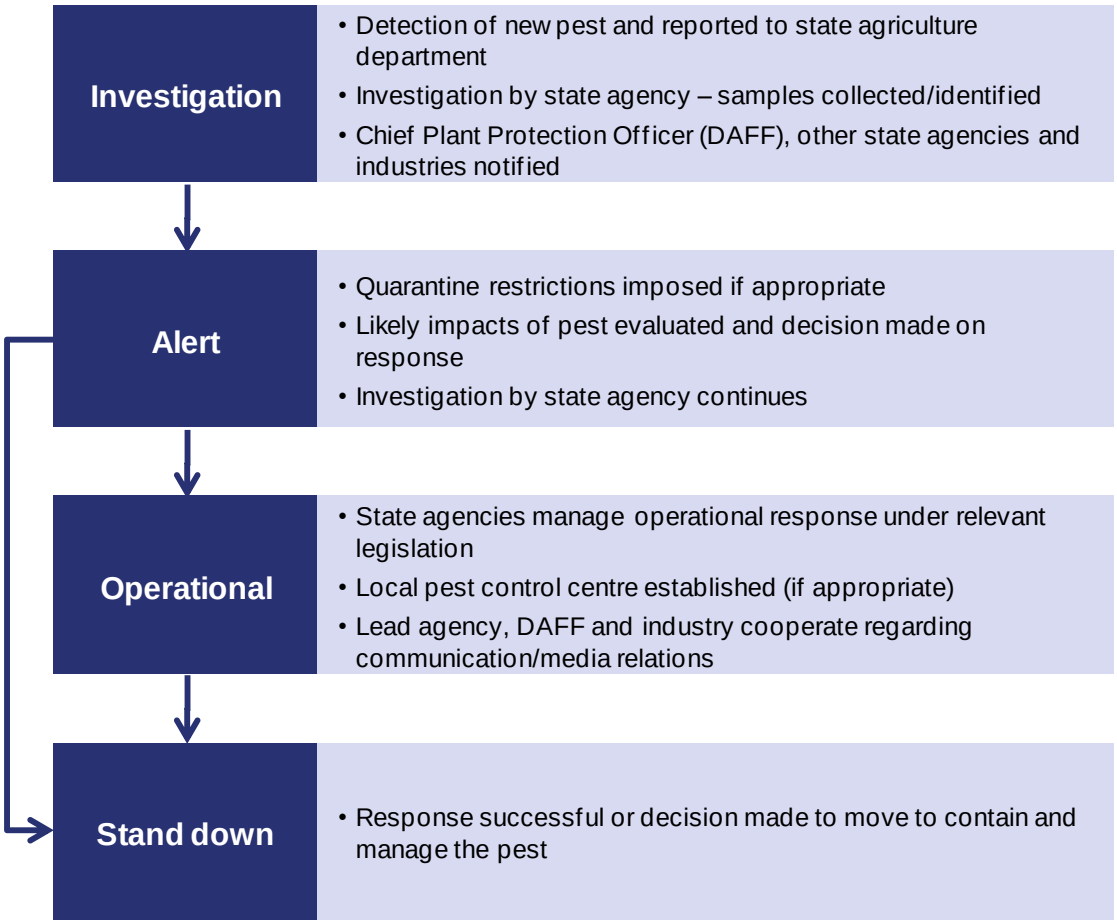

Figure 9. *General decision making and communication chain for a plant pest emergency response*

If the pest is considered potentially serious, then the relevant state/territory agriculture department may adopt precautionary measures. These measures, depending on the pest, may include:

- restriction of operations in the area
- withdrawal of people, vehicles and machinery from the area and disinfection
- restricted access to the area
- interim control or containment measures.

If a new plant pest is confirmed, technical and economic considerations are reviewed, and a decision made on whether to eradicate, contain or do nothing about the incursion (depending on the feasibility of the response and likely costs and impacts of the pest). Under the EPPRD all decisions are made by Committees with government and industry representation.
During this investigation/alert period, the affected area will be placed under quarantine until a decision is made on whether to eradicate or control the pest. Once a decision has been made

on a suitable response, efforts enter the operational phase. Eradication or control methods used will vary according to the nature of the pest involved and infested material will be destroyed where necessary. All on ground response operations are undertaken by the relevant state department(s) in accord with relevant state/territory legislation.

In the stand down phase, all operations are wound down. Where a plant pest emergency was not confirmed, those involved will be advised that the threat no longer exists. Where an eradication or management/control campaign has taken place, quarantine measures will be finalised and reviewed.

Industry specific response procedures

Industry communication

In the event of a pest incursion affecting the NGI, NGIA will be the key industry contact point and will have responsibility for relevant industry communication and media relations (see PLANTPLAN for approved communications during an incursion). As outlined in Figure 10, NGIA will ensure coordination of communications with government agencies through participation on the Consultative Committee on Emergency Plant Pests (CCEPP) and National Management Group (NMG). NGIA should be contacted immediately to ensure those appropriate delegate/s are secured for meetings of the CCEPP or NMG. Regional or state based industry organisations will be informed of the incursion through the national industry contact. Key contacts for the NGI are provided in Table 18.

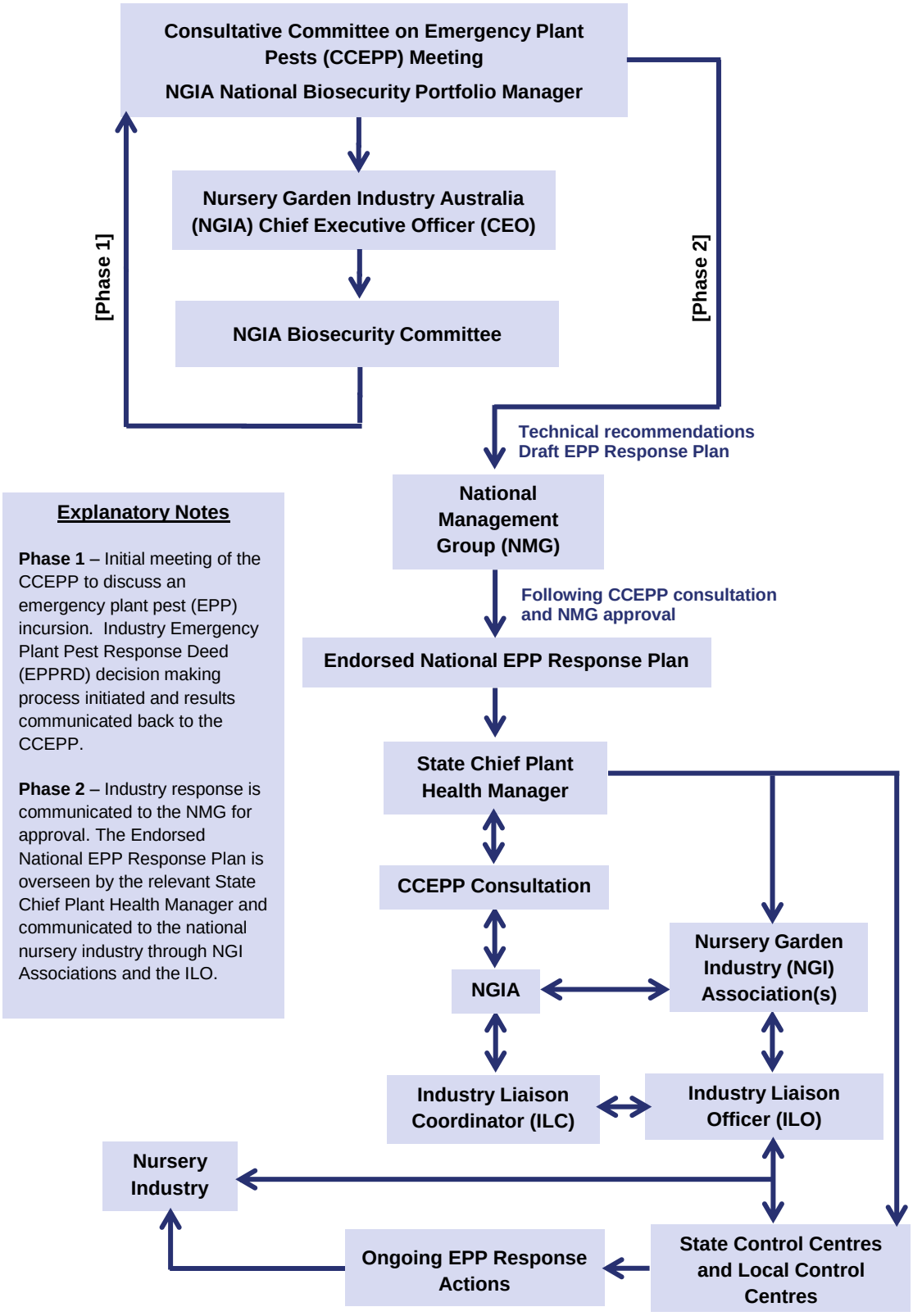

Figure 10. *Nursery and garden industry Emergency Plant Pest Response Deed incursion decision process following notification of an Emergency Plant Pest*

Roles and Responsibilities of Industry Liaison Coordinators and Industry Liaison Officers

During a plant pest emergency response, an Industry Liaison Coordinator (ILC) and Industry Liaison Officer (ILO) will be nominated by the national industry body. The ILC is often sourced from within the national industry organisation and in the event of an incursion is situated in the State Pest Control Headquarters (SPCHQ). The SPCHQ includes industry representatives at state/territory and national levels. The ILO is generally sourced from the local area (for example, an NGIA Industry Development Officer in the state in which the incursion occurs) and is situated in the Local Pest Control Centre (LPCC). The LPCC includes industry representatives at the local level.

The SPCHQ and LPCC industry representatives must work closely with each other. The ILC will consult with industry and be involved in development and implementation of the EPP Response Plan. Key ILC activities include:

- preparing comprehensive advice on the affected state/territory industry, including advice on its size, distribution, sources of supply, marketing practices, industry organisations and all other factors which may affect the eradication/control program (i.e. assist with risk assessment)
- providing advice on the practicality and other economic consequences of actions proposed for eradication/control purposes
- providing advice on plans for handling potentially contaminated material, including identifying the steps required to pick up, handle, process and distribute this material and limit the spread of infection
- consulting with other state/territory industry contacts about the campaign and acting as a focus for contact with national peak industry body(s)
- consulting with the ILO at the regional LPCC level and the CCEPP and NMG industry representatives on a regular basis.

ILOs liaise with the affected industry(s) and, if necessary, interstate ILOs where a pest outbreak crosses state/territory borders. Key activities include:

- preparing comprehensive advice on the affected local industry, including advice on its size, distribution, sources of supply, marketing practices, industry organisations and all other factors which may affect the eradication/control program (i.e. assist with risk assessment)
- providing advice on the practicality and other economic consequences of actions proposed for eradication/control purposes
- providing advice on plans for handling potentially contaminated material, including identifying the steps required to pick up, handle, process and distribute this material and limit the spread of infection

- consulting with other local industry contacts about the campaign and acting as a focus for contact with the local industry
- briefing the state/territory ILC and CCEPP representative on a daily basis.

Close cooperation is required between relevant government bodies and industry in regards to the effective management of a pest response and media/communication issues. Refer to PLANTPLAN for further information.

Table 18. *Key nursery and garden industry contacts*

Name	Organisation	Position	Contact Details
National			
	Nursery & Garden Industry Australia (NGIA)		**Street address** Unit 58, Quantum Corporate Park 5 Gladstone Road, Castle Hill NSW 2154 **Postal address** PO Box 7129 Baulkham Hills BC, NSW 2153 **Telephone:** (02) 8861 5100 **Fax:** (02) 9659 3446 **Email:** info@ngia.com.au **Website:** www.ngia.com.au
Robert Prince	NGIA	Chief Executive Officer (CEO)	**Telephone:** (02) 8861 5101 **Email:** robert.prince@ngia.com.au
Anthony Kachenko	NGIA	Environmental and Technical Policy Manager	**Telephone:** (02) 8861 5106 **Email:** anthony.kachenko@ngia.com.au
New South Wales and Australian Capital Territory			
	Nursery & Garden Industry New South Wales and Australian Capital Territory Ltd (NGINA)		**Address:** 344-348 Annangrove Road Rouse Hill, NSW 2155 **Telephone:** (02) 9679 1472 **Fax:** (02) 9679 1655 **Email:** info@ngina.com.au **Website:** www.ngina.com.au
David Foster	NGINA	CEO	**Telephone:** (02) 9679 1472 **Email:** davidfoster@ngina.com.au
Michael Danelon	NGINA	Industry Development Officer	**Telephone:** (02) 9679 1472 **Email:** michael@ngina.com.au

Name	Organisation	Position	Contact Details
Queensland			
	Nursery & Garden Industry Queensland (NGIQ)		**Street address** Unit 1 The Grove, Cnr. Orange Grove & Riawena Rds, Salisbury, QLD 4107 **Postal address** Post Office Box 345 Salisbury, QLD 4107 **Telephone:** (07) 3277 7900 **Fax:** (07) 3277 7109 **Email:** info@ngiq.asn.au **Website:** www.ngiq.asn.au
Donald Scotts	NGIQ	Executive Officer	**Telephone:** (07) 3277 7900 **Email:** info@ngiq.asn.au
John McDonald	NGIQ	Nursery Industry Development Manager	**Telephone:** (07) 3277 7900 **Email:** nido@ngiq.asn.au
Victoria			
	Nursery & Garden Industry Victoria (NGIV)		**Street address** 3/307 Wattletree Road Malvern East VIC 3145 **Postal address** PO Box 2280, Wattletree Road LPO East Malvern, VIC 3145 **Telephone:** (03) 9576 0599 **Fax:** (03) 9576 0431 **Email:** ngiv@ngiv.com.au **Website:** www.ngiv.com.au
Euan Laird	NGIV	CEO	**Telephone:** (03) 9576 0599 **Email:** euan@ngiv.com.au
David Reid	NGIV	Nursery Industry Development Officer	**Telephone:** (03) 9576 0599 **Email:** david@ngiv.com.au
Northern Territory			
	Nursery & Garden Industry Northern Territory (NGINT)		**Postal address** PO Box 348 Palmerston, NT 0831 **Telephone:** (08) 8983 3233 **Fax:** (08) 8983 3244 **Email:** ngint@ntha.com.au

Name	Organisation	Position	Contact Details
Michelle Shugg	NGINT	Executive Officer	**Telephone:** (08) 8983 3233 **Email:** ngint@ntha.com.au
South Australia			
	Nursery & Garden Industry South Australia (NGISA)		**Street address** 505 Fullarton Road Netherby, SA 5062 **Telephone:** (08) 8372 6822 (08) 8271 1012 **Fax:** (08) 8372 6833 **Email:** gfuller@ngisa.com.au **Website:** www.ngisa.com.au/home
Geoffrey Fuller	NGISA	CEO	**Telephone:** (08) 8372 6822 **Email:** gfuller@ngisa.com.au
Grant Dalwood	NGISA	Nursery Industry Development Officer	**Telephone:** (08) 8372 6833 **Email:** gdalwood@ngisa.com.au
Western Australia			
	Nursery & Garden Industry Western Australia (NGIWA)		**Postal address** PO Box 135 Mount Helena, WA 6082 **Telephone:** 0419 930 008 **Email:** reception@ngiwa.com.au
Esther Ngang	NGIWA	CEO	**Telephone:** 0411 056 966 **Email:** esther.ngang@ngiwa.com.au
Trevor Winter	NGIWA	Nursery Industry Development Officer	**Telephone:** 0467 555 226 **Email:** trevor.winter@ngiwa.com.au
Tasmania			
	Nursery & Garden Industry Tasmania (NGIT)		**Street address** 9 Takari Place Mornington, TAS 7018 **Postal address** PO Box 3009 Rosny Park, TAS 7018 **Telephone:** (03) 6244 7977 **Fax:** (03) 6244 7977 **Email:** ngit@bigpond.com
Karen Brock	NGIT	President	**Telephone:** 0439 972 793 **Email:** brocklands@bigpond.com
Mark Geeves	NGIT	NGIA Representative	**Telephone:** 03 6232-7366 **Email:** mark.geeves@education.tas.gov.au

Counselling and support services

Whilst incursion response procedures, including quarantines, are critical in preventing a pests' further spread, such activities can impose a significant emotional and financial strain on nursery and garden businesses and their owners. Provision for counselling and advice on financial support for growers is made available through various agencies as listed in Table 19. Up-to-date information relating to mental health can be found at **www.health.gov.au/mentalhealth**. Local providers of counselling services can be found through contacting your local state or territory agriculture agency (Table 12) or your growers association (Table 18).

Table 19. *Counselling and financial counselling services*

Organisation	Contact
Lifeline	**13 11 14** (24 hours) **www.lifeline.org.au** Anyone can call Lifeline. The 13 11 14 service offers a counselling service that respects everyone's right to be heard, understood and cared for. We also provide information about other support services that are available in communities around Australia.
Mensline	**1300 789 978** (24 hours) **www.menslineaus.org.au** Mensline Australia is a dedicated service for men with relationship and family concerns.
Kids Help Line	**1800 551 800** (24 hours) **www.kidshelpline.com.au** Kids Help Line is Australia's only free, confidential and anonymous, telephone and online counselling service specifically for young people aged between 5 and 25.
BeyondBlue	**1300 224 636** **www.beyondblue.org.au** Beyondblue is an independent, not-for-profit organisation working to increase awareness and understanding of depression, anxiety and related substance-use disorders throughout Australia and reduce the associated stigma.
Centrelink	**13 23 16** (Drought Assistance Hotline) **www.humanservices.gov.au/customer/subjects/drought-assistance** The Exceptional Circumstances Relief Payment is delivered by Centrelink on behalf of the Department of Agriculture, Fisheries and Forestry. The payment provides assistance to farmers living in 'exceptional circumstances' affected areas who are having difficulty meeting family and personal living expenses.

Organisation	Contact
Rural Financial Counselling Service	**1800 686 175** (free call for referral to your nearest Rural Financial Counselling Service provider) **www.daff.gov.au/agriculture-food/drought/rfcs** Rural financial counsellors can: • help clients identify financial and business options • help clients negotiate with their lenders • help clients adjust to climate change through the Climate Change Adjustment Program, identify any advice and training needed and develop an action plan • help clients meet their mutual obligations under the Transitional Income Support program • give clients information about government and other assistance schemes • refer clients to accountants, agricultural advisers and educational services • refer clients to Centrelink and to professionals for succession planning, family mediation and personal, emotional and social counselling.

Pest-specific emergency response and information documents

As part of the implementation of the IBP, pest-specific information and emergency response documents, such as fact sheets, contingency plans and diagnostic protocols should be developed over time for all medium to high risk pests listed in the TSTs (Appendix 1). A number of documents have been developed for pests of the NGI (Table 20) and are available for download from the Pest Information Document Database at **www.planthealthaustralia.com.au/pidd**. Over time, pest risk reviews will be replaced through the development of pest specific contingency plans.

Table 20. *Pest-specific information documents for the nursery and garden industry*

Common name	Scientific name	Contingency plan	Fact sheet	Pest risk review	Diagnostic protocol
Citrus longicorn beetle	*Anoplophora chinensis*	✓	✓		
Citrus greening	*Candidatus* Liberibacter asiaticus	✓[76]	✓[77]	✓	

[76] Developed by DAFF Qld for NGIA
[77] Available from DAFF Qld website (**www.daff.qld.gov.au/4790_10827.htm**)

Common name	Scientific name	Contingency plan	Fact sheet	Pest risk review	Diagnostic protocol
Poinsettia thrips	*Echinothrips americanus*	✓		✓	✓[78]
Flavescence doreé	*Flavescence doreé phytoplasma*			✓	
Glassy-winged sharpshooter	*Homalodisca vitripennis*	✓	✓	✓	✓
Pea leafminer	*Liriomyza huidobrenis*	✓	✓	✓	✓
American leafminer	*Liriomyza sativae*	✓	✓	✓	
American serpentine leafminer	*Liriomyza trifolii*	✓	✓	✓	✓
Tarnished plant bug	*Lygus lineolaris*	✓	✓	✓	
Asian gypsy moth	*Lymantria dispar*	✓	✓	✓	
Mal Secco	*Phoma tracheiphila*		✓	✓	
Sudden oak death	*Phytophthora ramorum*	✓	✓	✓	✓[78]
Guava/Eucalyptus rust	*Puccinia psidii*	✓	✓		
Red palm weevil	*Rhynchophorus ferrugineus*			✓	
Citrus stubborn disease	*Spiroplasma citri*		✓	✓	
Spider mites	*Tetranychus* spp.		✓	✓	✓
Citrus canker	*Xanthomonas citri* subsp. *citri*			✓	✓[78]
Pierce's disease	*Xylella fastidiosa*	✓	✓	✓	✓[78]
Bacterial blight	*Xylophilus ampelinus*[79]			✓	
Zucchini lethal chlorosis virus	*Zucchini lethal chlorosis virus*			✓	
Aphid transmitted viruses:					
Plum pox potyvirus	*Plum pox virus*	✓	✓	✓	✓[78]
Tobacco etch virus	*Tobacco etch virus*	✓			
Thrips transmitted viruses:					
Chrysanthemum stem necrosis virus	*Crysanthemum stem necrosis virus*	✓			
Tomato spotted wilt virus	*Tomato spotted wilt virus*	✓			
Impatiens necrotic spot virus	*Impatiens necrotic spot virus*	✓			
Pelargonium flower break virus	*Pelargonium flower break virus*	✓			

[78] Nationally endorsed diagnostic protocol
[79] Synonym: *Xanthomonas ampelina*

Common name	Scientific name	Contingency plan	Fact sheet	Pest risk review	Diagnostic protocol
White fly transmitted viruses:					
Tomato yellow leaf curl virus	*Tomato yellow leaf curl virus*	✓			
Lettuce infectious yellows virus	*Lettuce infectious yellows virus*	✓			
Beet pseudo-yellows virus	*Beet pseudo-yellows virus*	✓			
Diodia vein chlorosis virus	*Diodia vein chlorosis virus*	✓			

National diagnostic standards for priority plant pest threats

National diagnostic standards have been commissioned for a number of exotic/emergency plant pests. These protocols would be used nationally in the event of an incursion, thus ensuring a rapid response and nationally consistent test results that are directly comparable. However, given the rapid development of improved molecular diagnostic techniques, these protocols need to be regularly reviewed and updated.

The development and endorsement of these protocols is managed by SPHDS. Diagnostic standards that have been formally nationally endorsed are available on the SPDHS website (**www.padil.gov.au/Sphds**). For pests in which there is currently no nationally endorsed diagnostic protocol, diagnostic information can be accessed through the PaDIL Biosecurity Toolbox (**www.old.padil.gov.au/pbt**). Further information on diagnostic standards and their endorsement process can be found on the SPHDS website.

Reference

Plant Health Australia (2011) PLANTPLAN: Australian Emergency Plant Pest Response Plan. Plant Health Australia, Canberra, ACT. (**www.planthealthaustralia.com.au/plantplan**)

APPENDIX 1: THREAT SUMMARY TABLES

Nursery and garden industry threat summary tables

The information provided in the TSTs (invertebrates, Table 21 and pathogens, Table 22) is an overview of exotic plant pest threats to the NGI. It is important to recognise that this list is not intended to be a full list of pest threats for the industry, rather it lists example pest threats chosen from each functional category of pests, with these examples to serve as a basis for planning. Summarised information on entry, establishment and spread potentials and economic consequences of establishment are provided where available. Pests under official control[80] or eradication may be included in these tables where appropriate. However, NGI pests that are endemic but regionalised within Australia are not covered by IBPs, but may be assessed in state biosecurity plans. Assessments may change given more detailed research, and will be reviewed with the biosecurity plan.

Additional information on a number of the pests listed in the TSTs can be found in pest-specific information documents (Table 20). An explanation of the method used for calculating the overall risk can be found on the PHA website[81].

Description of terms

The descriptions below relate to terms in the TSTs (Table 21 and Table 22). Full descriptions of the risk rating terms can be found on page 26.

Life form legend

Bac	Bacteria
Btle	Beetles, weevils, etc. (COLEOPTERA)
Bug	Stink bugs, aphids, mealybugs, scale, whiteflies and hoppers (HEMIPTERA)
Fly	Flies and midges (DIPTERA)
Fun	Fungi
Gast	Snails and slugs (GASTROPODA)
Lep	Butterflies and moths (LEPIDOPTERA)
Mite	Mites e.g. spider and gall mites (ACARI)

[80] Official control defined in ISPM No. 5 as the active enforcement of mandatory phytosanitary regulations and the application of mandatory procedures with the objective of eradication or containment of quarantine pests or for the management of regulated non-quarantine pests

[81] Available from **www.planthealthaustralia.com.au/biosecurity/risk-mitigation**

Nem	Nematodes
Oom	Oomycetes
Thri	Thrips (THYSANOPTERA)
Vir	Viruses and viroids

Invertebrates

Table 21. *Nursery and garden industry invertebrate threat summary table.*

Note that this TST does not include a full list of invertebrate threats for the NGI. It lists example invertebrate threats that were agreed should be given specific consideration in the NGI IBP. In addition, example invertebrates of relevance to the NGI, for which information exists in other IBPs, are included.

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Emerald ash borer	Btle	*Agrilus planipennis*	Ash (*Fraxinus* spp.)	Leaves, stems	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Citrus longicorn beetle[82]	Btle	*Anoplophora chinensis*	Broad host range including citrus, *Acacia* spp., apples, pear, willow, poplar, maple, rose and fig	Stems, roots, leaves	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Asian longicorn beetle	Btle	*Anoplophora glabripennis*	Maple, horse chestnut, Alders, birches, ash, *Malus* spp., plane trees, poplars, *Pyrus* spp., rose, willow and elm	Stems	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
White spotted longicorn beetle	Btle	*Anoplophora malasiaca*	Wide range of woody plants including citrus alder, willows and pears	Stems, leaves	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Plum curculio[83]	Btle	*Conotrachelus nenuphar*	Peach, apricot, plum, cherry and summerfruit	Fruit	LOW	MEDIUM	MEDIUM - HIGH	LOW	**VERY LOW**
Colorado potato beetle	Btle	*Leptinotarsa decemlineata*	Solanaceae including tomato, potato and eggplant	Leaves, stems and vegetative organs	LOW - MEDIUM[84]	MEDIUM	HIGH	LOW	**VERY LOW**
Powder post beetle	Btle	*Lyctus africanus*	Attacks sapwood of wide-pored hardwoods provided the sapwood has sufficient starch content	Sapwood of hardwoods	HIGH	MEDIUM	MEDIUM	LOW	**VERY LOW**

[82] Synonym: Black and white citrus longhorn
[83] Synonym: Plum weevil
[84] Intercepted at border but narrow host range

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Longhorn beetles	Btle	*Monochamus* spp.	*Pinus* spp., spruce, fir, larches, hemlocks and other softwoods	Whole plant, fruits, pods, leaves, stems	MEDIUM	HIGH	LOW	LOW	**VERY LOW**
Japanese beetle	Btle	*Popillia japonica*	Broad host range including apple, stone fruit, rose, grapevine, maple and rhubarb	Whole plant	MEDIUM	MEDIUM	MEDIUM	LOW	**VERY LOW**
Red palm weevil	Btle	*Rhynchophorus ferrugineus*	Various palms including coconut, oil palm, sago palm, date palm and Canary Island date palm	Leaves, stem	LOW	HIGH	HIGH	MEDIUM	**LOW**
Black twig borer[85]	Btle	*Xylosandrus compactus*	Broad host range across over 225 species including soursop, tea, coffee, *Acacia* spp., cinnamon, macadamia, mango, avocado, pine and mahogany	Stem	MEDIUM	HIGH	HIGH	LOW	**LOW**
Coconut bug	Bug	*Amblypelta cocophaga*	Coconut, mango, papaw, melon, kapok, navel orange, cassava, peach, sugarcane, cocoa and *Eucalyptus deglupta*	Stems, growing points, and fruit	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**
Bean aphid	Bug	*Aphis fabae*[86]	Very broad host range with over 200 hosts including beans, peas, beets, crucifers, cucurbits, chilli capsicum, tomato, potato, maize, fennel, cotton and ornamentals including dahlia and tulip	Leaves	HIGH	HIGH	HIGH	LOW - MEDIUM	**LOW - MEDIUM**

[85] Synonym: Shot-hole borer
[86] Transmits over 30 pathogenic viruses

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Cotton aphid	Bug	*Aphis gossypii* (exotic strains)[87]	Very broad host range including cotton, papaya, citrus, capsicum, melon, cucumber, pumpkin, carnation, sunflower, jasmine, lettuce, lychee, macadamia, apple, passionfruit, avocado, tomato, potato, maize, Asteraceae, Myrtaceae, Ranunculaceae and roses	Leaves, inflorescence, stems	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Tomato/Potato psyllid	Bug	*Bactericera cockerelli*	Potato, tomato, capsicum, eggplant and other solanaceous crops	Leaves	HIGH	HIGH	HIGH	VERY LOW - LOW	**VERY LOW - LOW**
Silverleaf whitefly	Bug	*Bemisia tabaci* (exotic strains)[88]	Broad host range across vegetables & ornamentals including chrysanthemum and poinsettia. Vectors over 60 viruses[89].	Leaves, stems	MEDIUM	HIGH	HIGH	MEDIUM - HIGH[90]	**MEDIUM - HIGH**
Tortoise wax scale	Bug	*Ceroplastes japonicus*	Maple, tea, citrus, persimmon, ivy, holly, jasmine, sweet bay and *Prunus* spp.	Leaves, stems	LOW	HIGH	HIGH	LOW	**VERY LOW**
Grapevine phylloxera (exotic strains)	Bug	*Daktulosphaira vitifoliae* (exotic strains)	Grapevine	Roots, leaves	MEDIUM -HIGH	HIGH	MEDIUM	MEDIUM	**LOW - MEDIUM**

[87] Exotic strains may have different insecticide resistance profiles or cause differing levels of damage than strains already in Australia

[88] Recently published information suggests exotic strains might actually be different species for which taxonomic differentiation has not yet been established (Tay WT, Evans GA, Boykin LM and De Barro PJ. 2012, Will the real *Bemisia tabaci* please stand up? *PlosOne* 7(11): e50550). It is now considered that there is sufficient biological, behavioural and molecular genetic data to support it being a cryptic species complex composed of at least 34 morphologically indistinguishable species.

[89] Genera include Begomovirus, Closterovirus, Nepovirus, Carlavirus and Potyvirus. Begomoviruses (Whitefly-transmitted geminiviruses) are the most important of these agriculturally, causing yield losses to crops of between 20 and 100% (Brown JK and Bird J, 1992. Whitefly-transmitted geminiviruses and associated disorders in the Americas and the Caribbean Basin. *Plant Disease*, 76(3):220-225).

[90] Economic impact high in the presence of vectored viruses

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Citrus whitefly	Bug	*Dialeurodes citri*	Broad host range including citrus, pear, myrtle, gardenia, ivy, jasmine, stonefruit, magnolia, privet, blackberry, raspberry and castor bean	Fruit, flowers, leaves, stem	LOW	HIGH	HIGH	MEDIUM	**LOW**
Asian citrus psyllid	Bug	*Diaphorina citri*[91]	Citrus spp. and citrus relatives; *Atalantia*, *Citropsis*,*Limonia*, *Murraya*, *Bergera* and *Clausena*	Fruit, flowers, leaves, stem	MEDIUM - HIGH	HIGH	HIGH	MEDIUM[92]	**MEDIUM**
Grey pineapple mealybug	Bug	*Dysmicoccus neobrevipes*	Broad host range across over 100 genera in 53 families including pineapple, apple, citrus, banana, cotton, tomato, vegetables, maize, sugarcane, avocado, mango, ginger, grasses and clover	Leaves, stems, inflorescence, fruit	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Glassy-winged sharpshooter	Bug	*Homalodisca vitripennis*[93]	Very broad host range including citrus, crape myrtle, *Prunus* spp., blackberry, bottlebrush, bougainvillea, camellia, acacia, daylily, dianthus, chrysanthemum, macadamia, pistachio and grapevine. Host lists continue to grow, primarily within ornamental plant spp.	Leaves, stems	MEDIUM[94]	HIGH	HIGH	MEDIUM - HIGH[95]	**MEDIUM - HIGH[96]**

[91] Vectors Huanglongbing (American and Asiatic strains)
[92] Economic impact medium if vectoring Huanglongbing. Predominant impact to NGI is on market access rather than causing host mortality or yield loss.
[93] Synonym: *Homalodisca coagulata*
[94] Entry via host-plant for plantings, cutflowers and branches, fruits
[95] Economic impact high if vectoring viruses and/or *Xylella fastidiosa.*
[96] Overall risk high if vectoring viruses and/or *Xylella fastidiosa*

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Western plant bug	Bug	*Lygus hesperus*	Feeds primarily on cotton and strawberry plus can feed on 400 different plant species	Leaves, stems, inflorescence	LOW-MEDIUM	HIGH	HIGH	MEDIUM	**LOW - MEDIUM**
Tarnished plant bug	Bug	*Lygus lineolaris*	Broad host range including vegetables, strawberry, peach, crimson clover, *Aster* spp., chrysanthemum, dahlia and impatiens	Leaves	MEDIUM[97]	HIGH	HIGH	MEDIUM	**MEDIUM**
Papaya mealy bug	Bug	*Paracoccus marginatus*	Broad host range (over 55 plants from 25 genera) including papaya, avocado, citrus, mango, cherry, pomegranate, hibiscus, cotton, tomato, eggplant, capsicum, bean, pea and sweet potato	Fruit, leaves, stems and trunk	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Vine mealybug	Bug	*Planococcus ficus*	Fig, mulberry, pomegranate and grapevine	Leaves, flowers, fruit	MEDIUM	MEDIUM	MEDIUM	MEDIUM	**LOW**
Citrus mealybug	Bug	*Pseudococcus cryptus*	Broad host range including citrus, coconut and Rutaceae	Fruit, leaves, stems	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**
Grape mealybug	Bug	*Pseudococcus maritimus*	Apple, damson, peach, plum, European pear and grapevine	Leaves, stems	MEDIUM	HIGH	HIGH	LOW	**LOW**
Coconut bug	Bug	*Pseudotheraptus wayi*	Coconut, macadamia, cashew nut, carambola, pecan, cinnamon, loquat, mango, avocado, guava and cocoa	Fruit, flowers	LOW	HIGH	HIGH	HIGH	**MEDIUM**
Blotch leafminer	Fly	*Amauromyza maculosa*	Chrysanthemums, dahlia and other Asteraceae	Leaves	MEDIUM[98]	HIGH	HIGH	VERY LOW	**VERY LOW**

[97] Entry on glasshouse ornamental plants for plantings and cutflowers
[98] Entry on infested plants and cuttings, including cutflowers

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Leafminer	Fly	*Chromatomyia horticola*	Broad host range including Asteraceae, Brassicaceae and Fabaceae	Leaves	MEDIUM	MEDIUM	MEDIUM	MEDIUM	**LOW**
Onion fly[99]	Fly	*Delia antiqua*	Onion, shallot, Japanese bunching onion (Welsh onion), leek, garlic , chives and flowering bulbs	Bulb, foliage, root, seedling	HIGH[100]	MEDIUM	HIGH	LOW	**LOW**
Bean fly[101]	Fly	*Delia florilega*	Onion, leek, cauliflower, cabbage, cruciferous crops, common bean, tomato, potato, maize, garlic and flowering bulbs	Bulb, seedling	HIGH	MEDIUM	HIGH	LOW	**LOW**
Chrysanthemum gall midge	Fly	*Diarthronomyia chrysanthemi*[102]	Chrysanthemum	Leaves	MEDIUM	HIGH	HIGH	LOW	**LOW**
Tomato leaf miner	Fly	*Liriomyza bryoniae*	Broad host range including cabbage, cucumber, lettuce and tomato	Leaves	HIGH	MEDIUM	HIGH	MEDIUM	**MEDIUM**
Serpentine leaf miner[103]	Fly	*Liriomyza huidobrensis*	Wide range of vegetable crops including eggplant, onion, potato, celery, gourd, lettuce and chrysanthemum	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
American leaf miner[104]	Fly	*Liriomyza sativae*	Wide range of vegetable and flower crops including eggplant, celery, peas, potato and tomato	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
American serpentine leaf miner	Fly	*Liriomyza trifolii*	Very broad host range including many vegetables, chrysanthemum, dahlia, *Dianthus* spp., *Aster* spp. and *Zinnia* spp.	Leaves	MEDIUM[102]	HIGH	HIGH	MEDIUM	**MEDIUM**

[99] Synonym: Onion maggot
[100] Larvae imported inside bulbs
[101] Synonyms: Bean seed maggot, Potato maggot, Turnip maggot
[102] Entry on infested plants and cuttings, including cutflowers
[103] Synonyms: Vegetable leaf miner, Potato leaf miner, Pea leaf miner
[104] Synonyms: Serpentine vegetable leaf miner, Vegetable leaf miner, Cabbage leaf miner, Tomato leaf miner

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Narcissus bulb fly	Fly	*Merodon equestris*	*Amaryllis*, *Galtonia, Flanthus*, *Hyacinthus*, *Iris*, *Leucofum, Narcissus, Scilla*, *Vallota, Allium,* lilies and tulips	Bulbs	MEDIUM - HIGH	MEDIUM - HIGH	HIGH	MEDIUM	**LOW - MEDIUM**
Carrot rust fly	Fly	*Psila rosae*	Carrot, parsnip, celery, parsley, as well as other members of *Apiaceae*	Roots, crown, petioles	HIGH	HIGH	MEDIUM - HIGH	LOW	**LOW**
Giant African snail	Gast	*Achatina fulica*	Broad host range including groundnut, *Brassica* spp., papaya, melon, ornamental gourd, carrot, white yam, banana and cocoa	Whole plant	HIGH	HIGH	MEDIUM - HIGH	HIGH[105]	**HIGH**
Golden apple snail	Gast	*Pomacea canaliculata*	Rice, taro, *Azolla* spp., wild rice (*Zizania* spp.)	Leaves, stems	HIGH	HIGH	HIGH	MEDIUM - HIGH[105]	**MEDIUM - HIGH**
Strawberry tortrix	Lep	*Acleris comariana*	Strawberry	Leaves	LOW	HIGH	MEDIUM	LOW	**VERY LOW**
Summer fruit tortrix	Lep	*Adoxophyes orana*	Apple, European pear, apricot, quince, blackcurrant, raspberry, peach and roses	Whole plant leaves, growing points, flowers, fruits	LOW	HIGH	HIGH	MEDIUM	**LOW**
Turnip moth	Lep	*Agrotis segetum*	Broad host range including *Brassica* spp., capsicum, daisy, chickpea, melon, carrot, carnation, freesia, cotton, sunflower, barley, sweet potato, lettuce, lucerne, spruce, pine, blackcurrant, tomato, potato, clovers, wheat, grapevine and corn	Leaves, stems, roots, seeds	MEDIUM	MEDIUM	HIGH	MEDIUM	**LOW**
Navel orangeworm	Lep	*Amyelois transitella*	Citrus, English walnut, pistachio, almond and grapevine	Nuts, leaves	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[105] Predominant impact to NGI is on market access rather than causing host mortality or yield loss

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Carnation tortrix[106]	Lep	*Cacoecimorpha pronubana*	Wide host range across over 100 plant species including acacia, azalea, carnations, chrysanthemum, *Euphorbia*, *Jasminum*, *Pelargonium*, *Rhododendron*, roses, *Rubus*, potato and bean	Leaves, inflorescence	MEDIUM[107]	MEDIUM	HIGH	LOW	**VERY LOW**
Peach fruit moth	Lep	*Carposina sasakii*	Stone fruit, apple, quince, pears and other fruit trees	Fruit, seeds	LOW - MEDIUM	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Oblique-banded leafroller	Lep	*Choristoneura rosaceana*	Broad host range including apple, cherry, stonefruit, pistachio, blackberry, raspberry, poplar, holly, willows and rose	Leaves, fruit	MEDIUM	MEDIUM	HIGH	LOW	**VERY LOW**
False codling moth	Lep	*Cryptophlebia leucotreta*	Broad host range including pineapple, carambola, soursop, capsicum, citrus, cotton, lychee, mango, avocado, peach, maize and guava	Fruit, leaves and seeds	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
South-African carnation tortrix	Lep	*Epichoristodes acerbella*[108]	Broad host range including carnations, chrysanthemum, strawberry, pelargoniums, stone fruit, lucerne, sorrel, roses and dock	Leaves	MEDIUM	MEDIUM	HIGH	LOW	**VERY LOW**
Corn earworm[109]	Lep	*Helicoverpa zea*	Maize, sorghum, cotton, legumes, tomato, lettuce, strawberry, sunflower, zucchini, cucumber, field crops and ornamental plants	Leaves, flowers	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[106] Synonym: Mediterranean carnation leafroller
[107] Entry on infested plants and cutflowers of carnations, chrysanthemums, pelargoniums, roses, etc.
[108] Accidentally imported to UK several times as a larva in carnations (*Dianthus*)
[109] Synonym: American bollworm, Torrento fruitworm

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Asian gypsy moth	Lep	*Lymantria dispar*	Extensive range of tree spp. including maples, oaks, elms, box elder, birches, chestnut, red gum, *Pinus* spp., *Prunus* spp., corn, apple and pear	Leaves, flowers	MEDIUM - HIGH	MEDIUM	HIGH	HIGH[110]	**MEDIUM - HIGH**
Forest tent caterpillar	Lep	*Malacosoma disstria*	Broad host range including maple, alder, birch, beech, ash, liquidambar, poplar, oak and apple	Causes defoliation	LOW	MEDIUM	LOW	MEDIUM	**VERY LOW**
White spotted tussock moth	Lep	*Orgyia thyellina*	Mulberry, pear, apple, cherry and plum	Leaves	LOW	MEDIUM	LOW	MEDIUM	**VERY LOW**
Cherry brown tortrix[111]	Lep	*Pandemis cerasana*	Quince, apple, peach, European pear, cherry, plum, nuts, blackcurrant, roses and raspberry	Leaves flowers, fruits	LOW	HIGH	HIGH	LOW	**VERY LOW**
Blue-striped nettle grub	Lep	*Parasa lepida*	Tea, coconut, rubber, cassava, mango, banana, capsicum, gardenia, *Eugenia*, *Nephelium*, *Cassia, Rosa* and *Gliricidia*	Leaves, fruit	MEDIUM	HIGH	HIGH	LOW	**LOW**
Variegated cutworm	Lep	*Peridroma saucia*	Broad host range including Asteraceae, Brassicaceae, Fabaceae, Solanaceae	Leaves, stems, fruit, seeds	LOW	LOW	LOW	MEDIUM	**VERY LOW**
Omnivorous leafroller	Lep	*Platynota stultana*	Citrus, bell pepper, cotton, lucerne, pomegranate, pear, grapevine, peach and maize	Leaves, fruit, flowers	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**
Olive moth[112]	Lep	*Prays oleae*	Olive, jasmine, privet, Ranunculaceae, *Phillyrea* and windflower	Leaves, inflorescence, fruit	HIGH	HIGH	HIGH	LOW	**LOW**

[110] Predominant impact to NGI is on market access rather than causing host mortality or yield loss
[111] Synonym: Barred fruit tree tortrix
[112] Synonym: Olive kernel borer

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Jute hairy caterpillar[113]	Lep	*Spilarctia obliqua*	Field crops, vegetables, culinary herbs, fibre plants, fruit trees, oil plants, hibiscus, liquidambar, pea, jute, tobacco and bean	Leaves	LOW	MEDIUM	MEDIUM	HIGH	**MEDIUM**
Fuchsia gall mite	Mite	*Aculops fuchsiae*[114]	Fuchsias only	Leaves, inflorescence	MEDIUM	HIGH	HIGH	VERY LOW	**VERY LOW**
Lewis spider mite	Mite	*Eotetranychus lewisi*[115]	*Euphorbia*, poinsettias, *Ricinus communis* (all Euphorbiaceae) , citrus and papaya	Leaves	MEDIUM - HIGH	HIGH	HIGH	LOW	**LOW**
Southern red mite	Mite	*Oligonychus ilicis*	Azalea, camellia, holly, boxwood, eucalyptus, oak, walnut, camphor laurel, rice, quince, cotoneaster, loquat, strawberry, pear and coffee and rhododendron	Leaves	HIGH[116]	MEDIUM	HIGH	MEDIUM	**MEDIUM**
Pierce's spider mite	Mite	*Tetranychus piercei*	Broad host range including *Ageratum* spp., peanut, papaya, African oil palm, sweet potato, banana and bean	Leaves, fruit	HIGH	HIGH	HIGH	MEDIUM	**MEDIUM**
Strawberry spider mite	Mite	*Tetranychus turkestani*	Roses, sword lily, oleander, capsicum, gladiolus hybrids, soybean, cotton, almond, peach and maize	Leaves	LOW - MEDIUM	LOW	LOW	MEDIUM	**VERY LOW**

[113] Synonym: Tiger moth
[114] Entry on infested plants and cuttings
[115] Entry on infested plants and cuttings. *Tetranychus urticae* (present in Australia) is a good model for control
[116] Detected in Sydney in late 1990s and was eradicated

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Stem and bulb nematode	Nem	*Ditylenchus dipsaci*, *D. destructor* (exotic strains)[117]	Broad host range across over 450 plant spp. including *Brassica* spp., *Allium* spp., pea, bean, potato, parsley, strawberry, hyacinth, daffodil, tulip, potato and corn	Roots	MEDIUM	HIGH[118]	MEDIUM	MEDIUM	**LOW**
Potato cyst nematode (white or pale)	Nem	*Globodera pallida*	The major hosts of restricted to the Solanaceae family, in particular potato, tomato and eggplant	Whole plant, leaves, roots and vegetative organs.	HIGH[119]	HIGH	HIGH	LOW	**LOW**
Potato cyst nematode (golden)	Nem	*Globodera rostochiensis* (exotic strains)[120]	Main hosts restricted to the Solanaceae, family, in particular potato, tomato and eggplant	Whole plant, leaves, roots, and vegetative organs	HIGH[121]	HIGH	HIGH	LOW	**LOW**
Carrot cyst nematode	Nem	*Heterodera carotae*	Carrot, other *Daucus* spp., *Torilis* spp. and olives	Roots	MEDIUM	HIGH	HIGH	LOW	**LOW**
Root knot nematode	Nem	*Meloidogyne incognita* (exotic strains)[122]	Broad host range including many ornamentals and vegetables, cotton and tobacco	Roots	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Citrus spreading decline nematode	Nem	*Radopholus citrophilus*	Over 200 plants act as secondary hosts, many of these are ornamentals. Also an important pest of banana and citrus.	Roots	MEDIUM	HIGH	HIGH	LOW	**LOW**
Poinsettia thrips[123]	Thri	*Echinothrips americanus*	Broad host range across ornamental plants, especially Araceae and Balsaminaceae	Leaves	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**

[117] Some strains present in Australia, however these are good examples of foliar nematodes of concern to the industry
[118] Some strains already present in Australia so new strains likely to successfully establish
[119] One strain of *G. rostochiensis* has entered the country and is currently restricted to Victoria. This suggests that other species with similar lifestyles (such as *G. pallida*) could also enter the country.
[120] There are five strains (Ro1, Ro2, Ro3, Ro4 and Ro5). Of these, only Ro1 is present and restricted in Victoria.
[121] Ro1 strain has entered Australia
[122] Some strains present in Australia, however is a good example of a root nematode of concern to the industry
[123] Synonym: Banded greenhouse thrips

Pathogens

Table 22. *Nursery and garden industry pathogen threat summary table*

Note that this TST does not include a full list of pathogen threats for the NGI. It lists example pathogen threats that were agreed should be given specific consideration in the NGI IBP. In addition, example pathogens of relevance to the NGI, for which information exists in other IBPs, are included.

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Apple proliferation phytoplasma	Bac	Apple proliferation phytoplasma	Apple and pear	Whole plant, leaves, stems, roots, fruit	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Shallow bark canker	Bac	*Brenneria nigrifluens*[124]	Walnut and sunflower	Trunk, branches	LOW - MEDIUM	LOW - MEDIUM	LOW - MEDIUM	LOW	**NEGLIGIBLE - VERY LOW**
Deep bark canker	Bac	*Brenneria rubrifaciens*[125]	Walnut	Trunk, branches	MEDUIM - HIGH	MEDIUM	MEDIUM	LOW	**VERY LOW**
Huanglongbing (African strain)[126]	Bac	*Candidatus* Liberibacter africanus[127]	Citrus[128], sweet orange, mandarin, tangelo, sour orange, trifoliate orange, grapefruit, lemon, lime, kumquat, Australian native citrus, Cape chestnut (*Calodendrum capense*) and *Vepris* spp.	Leaves, stems, flowers, fruit, roots, whole plant	LOW - MEDIUM	HIGH[129]	HIGH[129]	MEDIUM	**LOW - MEDIUM**

[124] Synonym: *Erwinia nigrifluens*
[125] Synonym: *Erwinia rubrafaciens*
[126] Synonym: Citrus greening
[127] Transmitted by the African citrus psyllid *Trioza erytreae*
[128] Huanglongbing can affect almost all citrus cultivars; relatives like sweet orange, tangelo and mandarin are the most susceptible, while lime, lemon, sour orange and trifoliate orange are the least susceptible
[129] Establishment and spread potentials high in the presence of the African citrus psyllid vector (*Trioza erytreae*)

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Huanglongbing (American strain)[130]	Bac	*Candidatus* Liberibacter americanus[131]	Citrus[132], sweet orange, mandarin, tangelo, sour orange, trifoliate orange, grapefruit, lemon, lime, kumquat, *Murraya* spp. and *Vepris* spp.	Leaves, stems, flowers, fruit, roots, whole plant	LOW - MEDIUM	HIGH[133]	HIGH[133]	MEDIUM	**LOW - MEDIUM**
Huanglongbing (Asiatic strain)[130]	Bac	*Candidatus* Liberibacter asiaticus[131]	Citrus[132], mandarin, sweet orange, tangelo, sour orange, trifoliate orange, navel orange, lime, lemon, kumquat, grapefruit, Australian native citrus, *Atalantia* spp., *Murraya* spp. *Clausena* spp., *Vepris* spp. and other rutaceous plants including ornamentals	Leaves, stems, flowers, fruit, roots, whole plant	MEDIUM - HIGH[134]	HIGH[133]	HIGH[133]	MEDIUM	**MEDIUM**
Zebra chip	Bac	*Candidatus* Liberibacter psyllaurous	Haplotypes A and B affect Solanaceae (potatoes etc.) Haplotype C affects Apiaceae (carrots and celery)	Whole plant	Ratings with vector HIGH[135] Ratings without vector HIGH[135]	HIGH LOW	HIGH LOW	LOW LOW	**LOW** **NEGLIGIBLE**
Ring rot	Bac	*Clavibacter michiganensis* subsp. *sepedonicus*	Potato, tomato, *Lycopersicon pimpinellifolium* (currant tomato) and eggplant	Whole plant	LOW[136]	HIGH	HIGH[137]	LOW	**VERY LOW**

[130] Synonym: Citrus greening
[131] Vectored by the Asian citrus psyllid (*Diaphorina citri*)
[132] Huanglongbing can affect almost all citrus cultivars; relatives like sweet orange, tangelo and mandarin are the most susceptible, while lime, lemon, sour orange and trifoliate orange are the least susceptible
[133] Establishment and spread potentials high in the presence of the Asian citrus psyllid vector (*Diaphorina citri*)
[134] Entry potential high on illegal budwood and high in the presence of the Asian citrus psyllid vector (*Diaphorina citri*). The Asiatic strain is the most widespread of the Liberibacter species. Its presence in locations of close proximity to Australia (Indonesia, East Timor and Papua New Guinea) increases the probability of entry of this strain compared to the African and American strains.
[135] Entry potential high both with and without vector (*Bactericera cockerelli*) as the bacteria could enter through other pathways (e.g. via cuttings, tubers etc). In addition haplotype A is currently in New Zealand and can disperse naturally.
[136] Given current import conditions
[137] Spread by contact via machinery and other equipment, with cutting knives, picker-type planters, contaminated grading machines and transport trucks important. Water can also spread the pathogen.

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Fire blight	Bac	*Erwinia amylovora*	Apples, pears, *Rubus* spp. quince, *Pyacantha* spp., cotoneaster, hawthorns, and other ornamental plants	Leaves, stems, fruit, flowers	LOW	HIGH	HIGH	LOW	**VERY LOW**
Bacterial fruit collapse[138]	Bac	*Erwinia chrysanthemi*[139] (exotic pathovars)	Pineapple, vegetables, onion, garlic, leek, chrysanthemum, carnation, pelargonium, philodendron, dahlia, tulip and cyclamen	Fruit	HIGH	HIGH	HIGH	LOW	**LOW**
European stone fruit yellows	Bac	European stone fruit yellows phytoplasma	Stone fruit, including peach, cherry, apricot and plum	Leaves, stems	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Flavescence doree phytoplasma	Bac	Flavescence doree phytoplasma	Grapevine (*Vitis* spp.)	Leaves, stems, inflorescence, roots, fruit	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Palm lethal yellowing	Bac	Palm lethal yellowing phytoplasma	Old world palms including coconut and date palms(requires an insect vector)	Fruit, inflorescence, foliage	MEDIUM	HIGH	HIGH	LOW - MEDIUM	**LOW - MEDIUM**
Bacterial canker	Bac	*Pseudomonas syringae* pv. *syringae* (exotic races)[140]	Broad host range including onion, leek, capsicum, chrysanthemum, citrus, cucumber, pumpkin, garden dahlia, hibiscus, walnut, lettuce, magnolia, mango, lucerne, rice, passionfruit, avocado, bean, poplar, stonefruit, azalea, roses, tomato, willows, clover, blueberries, grapevine and maize. Attacks plants from the seedling stage through to maturity.	Leaves, inflorescence, stems, pods, seeds, flowers, fruit	HIGH	HIGH	HIGH	MEDIUM - HIGH	**MEDIUM - HIGH**

[138] Synonym: Bacterial wilt of dahlia, Bacterial wilt of chrysanthemum, Bacterial wilt of ornamentals, Bacterial head rot of banana
[139] Synonym: *Dickeya chrysanthemi*
[140] Exotic races may be more virulent than those currently present in Australia

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Bacterial wilt[141]	Bac	*Ralstonia solanacearum* race 2	Moko (race 2) affects plants in the banana (Musaceae) and Heliconiaceae family	Whole plant	MEDIUM - HIGH	HIGH	HIGH	NEGLIGIBLE	**NEGLIGIBLE**
Stubborn	Bac	*Spiroplasma citri*	Broad host range including Amaranthaceae, horseradish, brassicas, citrus, plantain, wild radish and Johnston grass	Whole plant	MEDIUM	HIGH	HIGH	LOW	**LOW**
X Disease	Bac	X disease phytoplasma	Switch sorrel, rough medic, sweet cherry , sour cherry, peach, Japanese plum, chokecherry	Whole plant	MEDIUM	HIGH	HIGH	LOW	**LOW**
Citrus canker	Bac	*Xanthomonas citri* subsp. *citri*	Citrus	Whole plant	MEDIUM	HIGH	HIGH	LOW	**LOW**
Pierce's disease[142]	Bac	*Xylella fastidiosa* (exotic strains)[143]	Broad host range including ryegrass, maples, pecan, citrus, coffee, lucerne, oleander, sycamore, almond, peach, pear, Japanese plum, oak, blackberry, raspberry and grapevine	Whole plant	Ratings with vector[144] MEDIUM Ratings without vector LOW	MEDIUM MEDIUM	HIGH LOW	HIGH MEDIUM	**MEDIUM** **VERY LOW**
Bacterial blight[145]	Bac	*Xylophilus ampelinus*[146]	Grapevine	Leaves, stems	LOW	HIGH	MEDIUM	HIGH	**MEDIUM**
Filbert blight	Fun	*Anisogramma anomala*	Hazelnut, *Corylus* spp.	Branches, stems	MEDIUM	MEDIUM	LOW	LOW	**NEGLIGIBLE**
Black knot	Fun	*Apiosporina morbosa*	Stone fruit trees (*Prunus* spp.)	Branches	LOW	MEDIUM	LOW	LOW	**NEGLIGIBLE**

[141] Synonym: Moko disease
[142] Vectored by the Glassy-winged sharpshooter, *Homalodisca vitripennis* and other insects that belong to the spittlebug/ froghopper family (Cercopidae)
[143] There are multiple exotic strains of *Xylella fastidiosa* that are ususally based on pathogenicity and/or gene sequence. Strains appear to be host specific. For example, stonefruit infecting isolates tend to only infect stonefruit and likewise with pear, citrus and other crops.
[144] For further information on ratings refer to the Pierce's disease contingency plan available through the Pest Information Documents Database at **www.planthealthaustralia.com.au/pidd**
[145] Synonym: Canker of grapevine
[146] Synonym: *Xanthomonas ampelina*

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Leaf blight[147]	Fun	*Botrytis squamosa*	Onion, Japanese bunching onion (Welsh onion), leek and garlic	Leaf, seed	HIGH[148]	MEDIUM	HIGH	LOW	**LOW**
Oak wilt	Fun	*Ceratocystis fagacearum*	Oak trees and chestnut	Leaves, stems	LOW	MEDIUM	HIGH	LOW	**VERY LOW**
Dutch elm disease	Fun	*Ceratocystis ulmi*	*Ulmus* spp.(elms)	Leaves, stems, roots	LOW	HIGH[149]	HIGH[149]	LOW	**VERY LOW**
Camellia petal blight	Fun	*Ciborinia camelliae*[150]	Camellia (Japonica and Sasanqua types)	Leaves	LOW	MEDIUM	MEDIUM	NEGLIGIBLE	**NEGLIGIBLE**
Pine rusts	Fun	*Cronartium* spp.	*Pinus* spp.	Leaves (pine needles), stems	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Chestnut blight	Fun	*Cryphonectria parasitica*[151]	Chestnut trees, some oaks and eucalyptus	Whole plant, leaves, stems	LOW	HIGH	HIGH	NEGLIGIBLE	**NEGLIGIBLE**
Mal secco	Fun	*Deuterophoma tracheiphila*[152]	Citrus, *Citrofortunella* spp., macrocarpa, kumquats and *Poncirus* spp.	Fruit, leaves, stems	MEDIUM	MEDIUM	MEDIUM	LOW	**VERY LOW**
Dogwood anthracnose	Fun	*Discula destructiva*	*Cornus* spp. (dogwoods)	Leaves, stems	LOW	LOW	LOW	LOW	**NEGLIGIBLE**
Pine rusts **Example: Western gall rust**	Fun	*Endocronartium* spp. Example: *Endocronartium harknessii*	Pine trees (*Pinus* spp.)	Stems	MEDIUM	LOW	LOW	LOW	**NEGLIGIBLE**
Tea blister blight	Fun	*Exobasidium vexans*	Tea camellia (*Camellia sinensis*)	Leaves, stems	HIGH	MEDIUM	LOW	NEGLIGIBLE	**NEGLIGIBLE**
Pine pitch canker	Fun	*Fusarium circinatum*	Pine trees (*Pinus* spp.), especially *P. radiata*	Leaves (needles), stems	LOW - MEDIUM	HIGH	HIGH	NEGLIGIBLE	**NEGLIGIBLE**

147 Synonyms: Leaf rot/blast, Neck rot
148 Detected at border on several occasions
149 Vectored by the Elm bark beetle (*Scolytus multistriatus*), present in Australia
150 Synonym: *Sclerotinia camelliae*
151 Currently under an official eradication program
152 Synonym: *Phoma tracheiphila*

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Fusarium wilt	Fun	*Fusarium oxysporum* f. sp. *vasinfectum* (exotic races)	Cotton	Roots, stems, leaves, whole plant	MEDIUM	HIGH	HIGH	NEGLIGIBLE - LOW	**NEGLIGIBLE - LOW**
Basal stem rot[153]	Fun	*Ganoderma zonatum*	*Eucalyptus* spp. and ornamental palms, including coconut, African oil palm and betelnut palm	Leaves, stem	MEDIUM	HIGH	HIGH	LOW - MEDIUM	**LOW - MEDIUM**
Bakanae	Fun	*Gibberella fujikuroi*	Banana, rice, cotton, fig, leucaena, pines, gum arabic tree, sugarcane, tomato, eggplant, sorghum, cowpea and maize	Seedlings	LOW	HIGH	MEDIUM	LOW	**VERY LOW**
Scleroderris canker	Fun	*Gremmeniella abietina*	Various conifer s, including *Abies* spp, *Larix* spp., *Picea* spp., *Pinus* spp. and Douglas fir (*Pseudotsuga menziesii*)	Leaves, stems	MEDIUM	LOW	MEDIUM	LOW	**VERY LOW**
Apple and pear rusts	Fun	*Gymnosporangium* spp.	Apple, pear and other woody Rosaceae trees, Junipers and other Cupressaceae species	Leaves, stems	MEDIUM	LOW	LOW - MEDIUM[154]	LOW	**NEGLIGIBLE - VERY LOW**
Annosus root and butt rot	Fun	*Heterobasidion annosum*	Fir, pine, oak, rhododendron, peach, plum, spruce, larch, juniper, cypress, cedar, maple, alder and birch	Stems, roots, trunk	MEDIUM	LOW	MEDIUM	LOW	**VERY LOW**
Brown rot	Fun	*Monilinia fructigena*	Apple, pear, quince, stone fruit, apricot, plum, almond, peach, nectarine, Japanese plum, grapevine, azalea, roses, tomato, hazel nut, capsicum, blackberry, raspberry, strawberry, blueberry and fig	Fruit, blossoms, stems, leaves	HIGH	HIGH	HIGH	LOW	**LOW**
Asiatic brown rot	Fun	*Monilinia polystroma*	Apple, pear, stone fruit and quince	Fruit, blossoms, stems, leaves	HIGH	HIGH	HIGH	LOW	**LOW**

[153] Synonym: Ganoderma butt rot
[154] Spread potential dependant on availability of alternate hosts

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
European canker	Fun	*Neonectria ditissima*[155]	Mostly apple and pear trees. Also maples, birch, hickory, beech, ash, oak and elm	Stems and branches	HIGH[156]	MEDIUM	MEDIUM	LOW	**VERY LOW**
Phomopsis blight	Fun	*Phomopsis vaccinii*[157]	Blueberry and small cranberry	Stems, fruit, inflorescence	HIGH	HIGH	MEDIUM	NEGLIGIBLE	**NEGLIGIBLE**
Texas root rot[158]	Fun	*Phymatotrichopsis omnivora*	Broad range of plants, especially cotton. Also okra, peanut, sugar beet, pecan, legumes, fig, walnut, apple, *Prunus* spp., poplars, elms, willows and grapevine	Leaves, roots, stems	LOW	MEDIUM	HIGH	LOW - MEDIUM	**VERY LOW - LOW**
Potato late blight	Fun	*Phytophthora infestans* (exotic strains)[159]	Potato, tomato and other *Solanum* spp.	Whole plant	MEDIUM[160]	HIGH[161]	HIGH	LOW	**LOW**
Phytophthora blight	Fun	*Phytophthora kernoviae*	Broad host range including rhododendron, *Drimys winteri*, *Fagus sylvatica*, *Gevuina avellana*, *Hedera helix*, *Ilex aquifolium*, *Liriodendron tulipifera*, *Magnolia* spp., *Michelia doltsopa, Pieris formosa, Quercus ilex, Quercus robur* and *Vaccinium myrtillus*	Leaves, stems, whole plant	HIGH	HIGH	MEDIUM	MEDIUM - HIGH	**MEDIUM - HIGH**

[155] Synonym: *Nectria galligena*
[156] Has previously entered and been eradicated from Tasmania
[157] Synonym: *Diaporthe vaccinii*
[158] Synonym: Cotton root rot
[159] A2 mating type not present in Australia. Exotic strains of A1 and A2 mating types tend to be resistant to metalaxyl compared with old A1 populations, and new strains are more aggressive, active within wider environmental parameters and can infect main stem and petiole stems directly, as well as the petioles. Disease will occur earlier in the crop and disease potential will be high.
[160] Currently in Papua New Guinea and East Timor. Natural spread could introduce pathogen to northern Australia.
[161] Wide climatic range (especially A2 mating type). Natural entry into northern Australia would mostly affect northern regions but would be expected to move south over time by natural and assisted dispersal.

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sudden oak death	Fun	*Phytophthora ramorum*	Broad host range across 70 genera from 33 families including oak trees, Arbutus, *Lithocarpus* spp., fir, maple plants in Ericaceae family, *Eucalyptus gunnii,* beech, bay laurel, magnolia and yew. The known host range continues to expand with more research.	Stems, branches, leaves	MEDIUM	HIGH	HIGH	HIGH - EXTREME	**HIGH - EXTREME**
Guava/Eucalyptus rust	Fun	*Puccinia psidii* sensu lato (exotic variants)[162]	Myrtaceae	Leaves, shoots	HIGH	HIGH	HIGH	HIGH	**HIGH**
Rusts (exotic) of ornamental species[163]	Fun	Various genera (e.g. *Puccinia*, *Uromyces*, *Uredo*, *Coleosporium*, *Chrysomyxa*) and species within Example: 1) *Coleosporium asterum*	Collectively a wide range of ornamentals including carnation, chrysanthemum, China aster, daisy, daylily, geranium, gladiolus, snapdragon 1) China aster (*Callistephus chinensis*)	Leaves	HIGH	MEDIUM	HIGH[164]	LOW - MEDIUM	**LOW - MEDIUM**
Verticillium wilt	Fun	*Verticillium dahliae* (defoliating strains)[165]	Cotton, olive, potato, tomato, eggplant, sycamore, silk tree, rape, bell pepper, pecan and strawberry	Leaves	LOW	HIGH	MEDIUM	LOW - MEDIUM	**VERY LOW - LOW**
Powdery mildew	Oom	*Oidium pulcherrima*	Poinsettias	Leaves	LOW	HIGH	HIGH	LOW	**VERY LOW**
Red steele root rot	Oom	*Phytophthora frageriae* pv. *fragariae*	Strawberry	Roots, leaves, flowers and fruit	LOW	HIGH	HIGH	LOW	**VERY LOW**
Leaf spots, blights, bud rot	Oom	*Phytophthora* spp. (exotic species)	Genus has wide host range including trees, shrubs, palms, annuals and vegetables	Leaves, stems, inflorescence	MEDIUM	HIGH	HIGH	MEDIUM - HIGH	**MEDIUM - HIGH**

[162] Several variants that belong to the *Puccini psidii sensu lato* rust complex exist outside of Australia

[163] There are many fungal species that cause rust on ornamental crops. One exotic rust relevant to the NGI is listed as an example.

[164] Rust spores are carried easily on wind currents and also can be disseminated by water splash. Long-distance dispersal of rusts on ornamental plants is mainly attributed to the movement of infected plants.

[165] On cotton, strains of *V.dahliae* have been classified into two pathotypes: defoliating strains, which are highly virulent and can completely defoliate the plant, and non-defoliating strains, which are mildly virulent and cause wilt and partial or no defoliation. No defoliating strains have been detected in Australia, but non-defoliating strains of the pathogen are present.

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Sunflower downy mildew	Oom	*Plasmopara halstedii*	Plants in Asteraceae family including sunflowers *Ambrosia artemisifolia* and *Xanthium stumarium*	Stems, leaves, flowers	HIGH	MEDIUM	MEDIUM	LOW	**VERY LOW**
Various **Examples:** **1) Plum pox virus**[166] **2) Tobacco etch virus**	Vir	Aphid-transmitted viruses[167] Examples: 1) *Plum pox virus*[168] 2) *Tobacco etch virus*	In general, aphid-transmitted viruses affect vegetables and ornamentals 1) Plum, apricot, almond, peach, nectarine and cherry 2) Tobacco, tomato, capsicum and various weed species	Leaves, stems, flowers, fruit, seeds	LOW	HIGH	HIGH	HIGH	**MEDIUM**
Arabis mosaic virus (ArMV)[169]	Vir	*Arabis mosaic nepovirus*[170]	Occurs naturally in many species of wild and cultivated monocotyledonous and dicotyledonous plants	Seedling stage, vegetative growing stage, flowering stage, and fruiting stage	LOW - MEDIUM	LOW - MEDIUM[171]	LOW - MEDIUM[171]	LOW	**NEGLIGIBLE - VERY LOW**
Asparagus 1 potyvirus	Vir	*Asparagus 1 potyvirus*	Asparagus – asymptomatic		LOW	MEDIUM	HIGH	LOW	**VERY LOW**
Asparagus 2 Ilarvirus	Vir	*Asparagus 2 Ilarvirus*	Asparagus – symptoms are stunting and decline	Whole plant	LOW	MEDIUM	MEDIUM	LOW	**VERY LOW**

[166] Synonym: Sharka

[167] There are over 200 aphid vector species; these transmit viruses from several families including Bromoviridae, Caulimoviridae, Comoviridae, Closteroviridae, Luteoviridae, Potyviridae, Sequiviridae and some Nanoviruses and Sobemoviruses from unassigned families

[168] Transmitted by aphids including *Myzus persicae* (Green peach aphid) and *Aphis spiraecola* (Green citrus aphid) which are both widespread in Australia

[169] Synonym: Raspberry yellow dwarf virus

[170] Transmitted by the nematode *Xiphinema diversicaudatum*

[171] Medium in the presence of nematode vector

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Various **Example: Cucurbit yellow stunting disorder virus**	Vir	*Closteroviridae*[172] Example: *Cucurbit yellow stunting disorder virus*[173]	Cucurbits, melon, cucumber and watermelon	Leaves, whole plant (dwarfing)	MEDIUM - HIGH[174]	MEDIUM - HIGH[174]	MEDIUM - HIGH[174]	LOW	**VERY LOW - LOW**
Various **Example: Tobacco leaf curl virus (TLCV)**	Vir	*Geminiviridae*[175] Example: *Begomovirus - Tobacco leaf curl virus*[176]	Collectively a wide range of vegetables, cotton, cassava, wheat, clover, sugarcane and corn Example: Tomato, capsicum, papaya, tobacco, spinach and *Zinnia elegans*	Leaves, stem, fruit, whole plant (dwarfing)	MEDIUM - HIGH[177]	MEDIUM - HIGH[177]	MEDIUM - HIGH[177]	MEDIUM	**LOW - MEDIUM**

[172] Known vectors include the whitefly *Bemisia tabaci* and the aphids *Myzus persicae*, *Aphis fabae*, *Nasonovia lactucae*, *Macrosiphum euphorbiae*, plus other aphids to a lesser extent
[173] Transmitted by the whitefly *Bemisia tabaci* (present in Australia)
[174] In presence of vector(s)
[175] Genus *Begomovirus*: transmitted by whiteflies of *Bemisia* spp., Genus: *Curtovirus*: transmitted by leafhoppers or treehoppers, Genus: *Mastrevirus*: transmitted by leafhoppers, Genus: *Topocuvirus*: transmitted by treehoppers
[176] Transmitted by the whitefly *Bemisia tabaci* (present in Australia)
[177] High in the presence of vector(s)

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Various **Examples:**	Vir	*Nepovirus*[178] examples other than ArMV:	Collectively, a wide host range including fruit, vegetables and weeds	Leaves	LOW - MEDIUM	LOW - MEDIUM[181]	LOW-MEDIUM[181]	MEDIUM - HIGH	**VERY LOW - MEDIUM**
1) Ringspot of tomato		1) *Tomato ringspot virus*[179]	1) Quince, apple, *Pelargonium*, *Rubus, Ribes, Prunus, Vitis, Nicotiana tabacum*, dandelion, tomato						
2) Ringspot of raspberry		2) *Raspberry ringspot virus*[180]	2) *Fragaria vesca*, *Fragaria ananassa*, privet, *Ribes, Rubus, Narcissus pseudonarcissus, Prunus, Sambucus nigra, Vitis* and *Weigela*						
3) Black ring of tomato		3) *Tomato black ring virus*	3) Onion, leek, celery, sugarbeet, swede, turnip, capsicum, cucumber, strawberry, sword lily, lettuce, daffodil, common bean, peach, currants, blackberry, raspberry, tomato, potato and grapevine						
Pepino mosaic virus	Vir	*Pepino mosaic virus*[182]	Solanaceae, especially tomato, pepino, potato and eggplant. Also affects *Amaranthus* and *Nicotiniana* spp.	Leaves, fruit	MEDIUM[183]	HIGH	HIGH	LOW	**LOW**

[178] Known vectors include *Xiphinema* spp., *Longidorus* spp., and *Criconemoides* spp.
[179] Vectored by *Xiphinema americanum*
[180] Vectored by *Longidorus elongates* and *L. macrosoma*, transmitted by pollen to seed
[181] Medium in presence of nematode
[182] Highly contagious, touch transmitted
[183] Has been spreading internationally

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Potato spindle tuber viroid (PSTVd)[184]	Vir	Potato spindle tuber viroid (*Pospiviroid*)[185]	Potato, tomato, eggplant and other Solanaceae species	Whole plant[186]	HIGH[187]	HIGH	HIGH[188]	LOW	**LOW**
Various **Examples:**	Vir	Thrips-transmitted viruses[189] Examples:	Collectively a wide range of fruit, vegetables, ornamentals and weeds		Ratings for 3 examples:[192]				
1) Pelargonium flower break virus (PFBV)		1) *Pelargonium flower break virus* (*Carmovirus*)[190]	1) Pelargonium	1) Leaves, flowers	MEDIUM	HIGH	HIGH	LOW - MEDIUM	**LOW - MEDIUM**
2) Chrysanthemum stem necrosis virus (CSNV)		2) *Chrysanthemum stem necrosis virus* (*Tospovirus*)[191]	2) Tomato and chrysanthemum	2) Leaves, stems, inflorescence, whole plant (wilt)	LOW	HIGH	HIGH	LOW - MEDIUM	**VERY LOW - LOW**
3) Impatiens necrotic spot virus (INSV)		3) *Impatiens necrotic spot virus* (*Tospovirus*)[190]	3) *Impatiens*, chrysanthemum, *Gloxinia* spp., other ornamentals, lettuce, tomato, potato, blackberry, raspberry and capsicum	3) Leaves, whole plant (death)	MEDIUM	HIGH	HIGH	LOW - MEDIUM	**LOW - MEDIUM**

[184] 'Spindle tuber' in potato, and 'Bunchy top' in tomato

[185] PSTVd is currently under eradication in Australia. A national PSTVd surveillance program is underway that will enable consistent Australia-wide information to be compiled to determine whether background populations of PSTVd have established in Australia. The survey program will involve about 70 ornamental nurseries and 60 tomato growing properties across Australia.

[186] Symptoms rarely shown above ground

[187] Has entered Australia on multiple occasions on tomato. Tomato seed, potato tubers, tissue cultures and other host propagative material could introduce pathogen.

[188] Touch transmissible; also spread via infected seed, pollen and by aphids in the presence of Potato leaf roll virus

[189] Includes members of the genus *Tospovirus*, *Ilarvirus* (*Tobacco streak virus* and *Prunus necrotic ringspot virus)*, *Carmovirus* (*Pelargonium flower break virus)*, *Sobemovirus* (*Sowbane mosaic virus*) and *Machlomovirus* (*Maize chlorotic mottle virus*). Some of the virus-transmitting thrips species present in Australia include *Frankliniella occidentalis* (Western flower thrips), *Frankliniella schultzei* (Tomato thrips), *Thrips palmi* (Melon thrips), *Thrips tabaci* (Onion thrips), *Heliothrips haemorrhoidalis* (Greenhouse thrips) and *Thrips simplex* (Gladiolus thrips)

[190] Transmitted by *Frankliniella occidentalis* (present in Australia)

[191] Transmitted by thrips species *Frankliniella occidentalis* and *F.schultzei* (both present in Australia)

[192] Risk ratings vary depending on virus species

Common name	Life form	Scientific name	Host(s)	Affected plant part	Entry potential	Establishment potential	Spread potential	Economic impact	Overall risk
Tobacco rattle virus[193]	Vir	*Tobacco rattle virus* (exotic strains)[194]	Broad host range across over 100 species including potato, tobacco, beetroot, artichoke, capsicum, peas, beans, broad bean, iris and various other plant species as well as several weeds (amaranths, vetch, nightshade, chickweed, knotweed and bluegrass)	Leaves, stems, whole plant	MEDIUM[195]	HIGH[196]	MEDIUM[197]	LOW	**VERY LOW**
Various	Vir	*Tospovirus*	Collectively broad host range across vegetables, ornamentals and weeds	Leaves, stems, fruit, whole plant	MEDIUM - HIGH[199]	MEDIUM - HIGH[199]	MEDIUM - HIGH[199]	LOW - MEDIUM	**VERY LOW - MEDIUM**
Example: Zucchini lethal chlorosis virus (ZLCV)		Example: *Zucchini lethal chlorosis virus*[198]	Example: Cucurbits						
Whitefly-transmitted viruses	Vir	Whitefly-transmitted viruses[200]	Collectively a wide range of vegetables & nursery stock	Leaves, whole plant (stunting)	MEDIUM	HIGH	HIGH	MEDIUM	**MEDIUM**
Example: Lettuce infectious yellows virus		Example: *Lettuce infectious yellows virus*[201]	Example: Lettuce, beetroot, marrow, melon, carrot, cucurbits, watermelon and weeds including morning glory, *Helianthus* spp., *Lactuca canadensis*, small flowered mallow (*Malva parviflora*) and *Physalis heterophylla*						

[193] Synonym: Potato corky ring spot, Spraing of potato
[194] There are several strains of virus exotic to Australia
[195] Currently present in Australia within certain ornamental bulb species, however import conditions now imposed reduce the risk of entry of exotic strains
[196] Once established at a site, Tobacco rattle virus and its vector nematodes are very difficult to control or eradicate. It can remain alive for many years in a contaminated plot.
[197] Wide host range and transmitted by stem and bulb ground nematodes belonging to the genera *Trichodorus* and *Paratrichodorus*. Poorly transmitted by potato seed in general and contamination essentially occurs through earth moving activities and transport of contaminated seeds.
[198] Transmitted by *Frankliniella zucchini* (not present in Australia)
[199] High in the presence of vector(s) – many *Tospoviruses* are thrips-transmitted
[200] Includes some viruses belonging to the Geminiviridae and Closteriviridae families
[201] Transmitted by the whitefly *Bemisia tabaci* (present in Australia)

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